U.S. STEEL EDGAR THOMSON WORKS
Along the Monongahela River
Braddock
Allegheny County
Pennsylvania

HAER No. PA-384

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HISTORIC AMERICAN ENGINEERING RECORD

U.S. STEEL EDGAR THOMSON WORKS

HAER No. PA-384

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| LOCATION: | Along the Monongahela River in Braddock, Allegheny County, Pennsylvania |
| DATE OF CONSTRUCTION: | 1873-1875 |
| BUILDER: | Carnegie Brothers & Company (later the Carnegie Steel Company), with Alexander Holley as consulting engineer. Later additions designed primarily by the engineering department of the Carnegie Steel Company. |
| PRESENT OWNER: | USX (formerly United States Steel Corporation, the Carnegie Steel Company, and Carnegie Brothers & Company) |
| PRESENT USE: | Steel production |
| SIGNIFICANCE: | The Edgar Thomson Works (ET), named after the president of the Pennsylvania Railroad and early financial backer of the enterprise, was the first integrated Bessemer steel works constructed in the Pittsburgh district by Andrew Carnegie. Built primarily as a rail manufacturing facility, ET was the prototype of modern steel mill technology, design, and management. ET began an industrial transformation of the Monongahela Valley from a production center of scattered iron works to an integrated steel manufacturing district. ET continues to produce steel today. |
| HISTORIAN: | Michael G. Bennett, 1995 (with preliminary research by Lynne Snyder, 1989). |

PROJECT INFORMATION:

The U.S. Steel Edgar Thomson Works documentation project is part of a larger multi-year effort to document the historic steel mills of the Monongahela Valley by the Historic American Engineering Record (HAER), a division of the National Park Service, U.S. Department of the Interior, dedicated to documenting historically significant engineering and industrial works in the United States. The Monongahela Valley Recording project was co-sponsored in 1989-90 by the Steel Industry Heritage Task Force, Jo H. Debolt, Chair, and in subsequent years by the Steel Industry Heritage Corporation, August Carlino, Executive Director.

Documentation was prepared under the direction of G. Gray Fitzsimons, HAER Historian/Engineer. Formal photography was done by John McWilliams. Michael G. Bennett served as the project historian. Editors in HAER's Washington office were Dean Herrin, Michael G. Bennett, and Lisa Pfueller Davidson

Three additional steel mills were recorded as part of the 1989-90 documentation of historic steel mills in the Monongahela Valley:

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| U.S. Steel National Tube Works | HAER No. PA-380 |
| U.S. Steel Duquesne Works | HAER No. PA-115 |
| U.S. Steel Homestead Works | HAER No. PA-200 |

**CONTENTS**



*A complete list of inventoried structures is located at the beginning of the appendix. Historical information generally appears at the end of each section of the inventory.

## AN OVERVIEW HISTORY OF U.S. STEEL EDGAR THOMSON WORKS

The Edgar Thomson Works, built near Pittsburgh between 1872 and 1875 in Braddock, Pennsylvania, has achieved legendary status in American industrial history. By the 1890s, observers of the iron and steel industry referred to the mill with the Victorian reverence usually associated with monuments of the past, rather than the industrial present.[1] For over 120 years, ET (as it is known in the Monongahela Valley) has been a part of Pittsburgh's industrial landscape, and it continues to produce steel while other mills have long since closed. Gone, however, are the structures associated with its early history, including the Bessemer converters and the original No. 1 rail mill. In fact, few of the structures built before World War I still remain. ET's landscape continues to evolve with the changing technology and marketplace of the American steel industry.

As part of the HAER documentation of ET, this essay will be primarily a general internal history of the structural and technological developments of the Works. It will not focus on the business practices of Andrew Carnegie, the changing position of labor, or the relationship between the mill and the community of Braddock. Those historical developments merit a social and cultural analysis beyond the scope of this limited study. The industrialization of the Monongahela Valley did not stop at the mill gates. It extended into the communities to shape not only the physical environment, but also the values, beliefs and attitudes of the people.[2]

<u>The Idea</u>

On September 1, 1875, the Edgar Thomson Works rolled its first steel rails and began an industrial venture that

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[1] By the 1890s, editors of trade journals often referred to the "historic," or "great" Edgar Thomson Works, suggesting that the mill was held in high esteem during the period of rapid change in the iron and steel industry. For example, see "Matters at the Great Edgar Thomson Steel Works," <u>Iron Trade Review</u> 7 (February 12, 1891): 8; and "ET Open Hearth Plant," <u>Iron Trade Review</u> 54 (January 1, 1914): 1064.

[2] This essay is based upon research into trade journals, secondary sources, and field notes compiled by Lynne Snyder in 1989. Aspects of the mill's labor relations through the twentieth century have not been considered for this survey. The major strikes of 1909, 1919, and subsequent labor activity in the 1950s throughout the 1970s all affected ET and the town of Braddock.

revolutionized modern American manufacturing. The basis of ET's early successes was the technological vision of those who built the plant as the first rail-making facility designed specifically to produce Bessemer steel. As early as 1862, the Pennsylvania Railroad, under President J. Edgar Thomson, began experimenting with steel rails on some of its lines. As a material, steel offered many advantages over iron, including its added strength, flexibility, and lightness. Prior to the development of the Bessemer process in the 1850s, however, it was impossible to manufacture steel rails on a large scale economically. By the late nineteenth century, however, the rail market was considered the backbone of the steel industry, and was perhaps the most influential factor in the rapid rise of American steel.[3]

While Pittsburgh led the country in iron production by the mid-nineteenth century, it did not have a substantial steel manufacturing capability. By the late 1860s, William Coleman, a pioneer in Pittsburgh's iron industry, began to formulate an idea that would eventually lead to the construction of the Edgar Thomson Works. It was Coleman's intent to build a Bessemer mill capable of producing steel rails. During an industrial tour in 1871, Coleman visited Bessemer facilities in Troy, New York; Cleveland, Ohio; and Johnstown and Harrisburg, Pennsylvania. Coleman paid particular attention to the layout of the facilities, their reliance on mechanization, and the structure of the converting vessels themselves.[4]

Later in 1871, Coleman and Thomas Carnegie, brother of Andrew and husband to Coleman's daughter Lucy (for whom the famed Lucy furnaces were named), gained an option to buy 107 acres in Braddock Fields, farmland on the site of the massacre of the forces of General Braddock in 1755. Located on the eastern shore of the Monongahela River, the plot was less than ten miles from Pittsburgh's point, where the Monongahela and Allegheny rivers join to form the Ohio River, and was crossed by both the Pennsylvania, and the Baltimore and Ohio railroads. With both river and rail access outside of the increasingly dense and expensive urban environment, the site was an ideal position to receive raw materials from the coal and coke fields of southwestern Pennsylvania and the iron ore ranges of the Great Lakes region. Pittsburgh's many iron furnaces, including the

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[3] "The Manufacture of Steel Rails," in Scientific American 89 (December 12, 1903): 424.

[4] James Bridge, The Inside History of the Carnegie Steel Company: A Romance of Millions (New York: Aldine Book Company, 1903): 72-73.

record breaking Isabella and Lucy furnaces, were capable of providing a steady supply of iron for a Bessemer works. Before the first rails could be rolled, however, a long process of capital accumulation and technological development transpired.[5]

William Coleman and Thomas Carnegie were able to gain the support of numerous investors, including John Scott, president of both the Columbia Oil Company and the Pittsburgh Locomotive Works; David Stewart, Director of the Allegheny Valley Railroad; David McCandless, vice-president of Exchange National Bank; and William P. Shinn, a local businessman who later became general manager of the Edgar Thomson Works. Thomas Carnegie's efforts to get his brother Andrew involved initially failed due to Andrew's uneasiness about investing in a pioneering venture.[6] While accounts vary, Carnegie's reluctance apparently dissipated after a 1872 trip to England on behalf of the Pennsylvania Railroad, where he witnessed the viability of Bessemer rail production.

Returning to Pittsburgh with a new zeal for the project, Andrew Carnegie actively solicited additional investors in the new venture. On January 13, 1873, just two weeks after Coleman finalized the purchase of the Braddock land for $60,000, Carnegie, McCandless & Company was formed with $700,000 of working capital. The list of investors in the company reads like a who's who of the regional iron industry, and included Andrew Kloman and Henry Phipps, both partners with the Carnegie brothers in the Union Iron Mills Company of Pittsburgh. Andrew Carnegie was the principal investor in the venture, allocating $250,000 for the construction of the works.[7]

Ironically, the nationwide economic panic of 1873 proved instrumental in the development of the mill. In order to raise needed capital for the project, Carnegie, McCandless & Company issued bonds at $100 each. The largest share was bought by the president of the Pennsylvania Railroad, J. Edgar Thomson, an avid supporter of the project. In response to the panic, furthermore, the Pennsylvania legislature passed an act which authorized the creation of limited liability companies to counter the risks associated in partnership agreements. As a result of these two developments, Carnegie, McCandless & Company was dissolved on October 12, 1874 and replaced with the Edgar Thomson Steel

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[5] Bridge, 73.

[6] Bridge, 70-75.

[7] Bridge, 76.

Company, Ltd.[8] An additional $300,000 was raised, bringing the total investment in the company to $1,000,000.[9]

The panic of 1873 taught Carnegie a valuable lesson that would shape his business mentality: expand during recession and undercut competition when business returns to normal. This pattern would continue throughout the end of the nineteenth century. Carnegie also learned other lessons in his career which would directly impact the Edgar Thomson Works, including the emphasis of cost over profit, the value of backward and vertical integration of operations, and the reliance on scientific analysis and technological innovations to reduce costs and increase productivity. While he was no engineer, Carnegie actively surrounded himself with the most innovative minds in the industry, often finding his own successes in the expertise of others.

Alexander Holley and the "Group of Five"

> *If the scientist finds creative processes continuous in his domain, no less so does the engineer find it in his own. Creation of the raw materials on this planet has been a continuous process, and so is fast getting to be the creation of the finished product from them.*
> Charles Morgan, ASME, 1901 [10]

When Alexander Holley designed the Edgar Thomson Works, he was considered the premier engineer of Bessemer steel plants in

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[8] According to biographers of Andrew Carnegie, the mill was named after Thomson to gain the favor of the Pennsylvania Railroad in order to ensure favorable shipping rates and a steady customer of the mill's rails. While Thomson was reluctant to agree because of the unknown quality of the rails to be produced, he was later persuaded to accept the honor. For a discussion of Carnegie's business practices see Harold Livesay, Andrew Carnegie and the Rise of Big Business, (Boston: Little, Brown & Company, 1975), and Joseph Fraizer Wall, Andrew Carnegie, (New York: Oxford University Press, 1970).

[9] Bridge, 76.

[10] Charles H. Morgan, "Some Landmarks in the History of Rolling Mills," Transactions of the American Society of Mechanical Engineers 22 (1901): 62.

the country.[11] In the decade prior to the construction of ET, Holley refined Bessemer technology and designed numerous Bessemer plants in America. The Edgar Thomson Works, no doubt, benefitted from Holley's experience, and together with the managerial expertise of its owners and the technological knowledge of its workers, the mill exemplified modern American industrial organization.[12]

Alexander L. Holley was born into a wealthy family in Lakeville, Connecticut on July 20, 1832. His father, Alexander H. Holley, was the son of a prominent industrialist and later became governor of Connecticut. The young Alexander received his degree from Brown University in 1853, and began a job as a draftsman and machinist for Corliss and Nightingale of Providence, Rhode Island. Holley was an active writer of engineering news, serving as special correspondent to the New York Times and editor/owner of the journal Railroad Advocate. Holley was to become notable in the emerging profession of engineer-managers who found their opportunities as consultants to industrial enterprises.[13]

While Holley went on to achieve success in his profession as a founding member of the American Institute of Mining Engineers (1872) and the American Society of Mechanical Engineers (1879), as well as a leading proponent of progressive engineering education which stressed both practical and academic training, his influence was foremost in the development of the American steel industry. According to Holley's biographer Jeanne McHugh, Holley considered his work with the Bessemer converter a constant struggle, referring to the machine as the "grim sphinx."[14]

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[11] Peter Temin, Iron and Steel in Nineteenth Century America: An Economic Inquiry (Cambridge, MA: The M.I.T. Press, 1964): 133.

[12] Alfred D. Chandler, The Visible Hand: The Managerial Revolution in American Business (Cambridge, MA.: Harvard University Press, 1977).

[13] William H. Wisely, The American Civil Engineer, 1852-1974: The History, Tradition, and Development of the American Society of Civil Engineers (New York: American Society of Civil Engineers, 1974): 82, 193, and 216; and Committee on History and Heritage of American Civil Engineering, A Biographical Dictionary of American Civil Engineering (New York: American Society of Civil Engineers, 1972): 61-62.

[14] Jeanne McHugh, Alexander Holley and the Makers of Steel (Baltimore: Johns Hopkins University Press, 1980): 212.

This struggle began during a trip to England in 1863 where he studied British Bessemer practice, paying particular attention to the role of skilled workers in the relatively new field of spectral analysis during the blow of the converters. Bessemer steel is produced by forcing a blast of hot air through molten iron contained in a vessel called a converter. The oxygen combines with the carbon in the metal, increasing the temperature to the point where impurities in the iron are removed. During his trip, Holley negotiated with Henry Bessemer for an option on the American patent rights to the process for Winslow & Griswold of Troy, New York.[15] After his return to the United States, Holley got the opportunity to design an experimental Bessemer plant for Winslow & Griswold.[16]

Despite Holley's lack of knowledge in metallurgical chemistry, compounded with the unavailability of suitable refractory material and skilled labor, he was able to produce a steel ingot on April 27, 1865. As a result, Winslow & Griswold decided to purchase the patent rights in July of 1865.[17] Holley spent the rest of 1865 and 1866 in refining the process and designing a steam engine to provide the blow after experiments showed that a water wheel was not adequate for the job. In 1867, Holley moved to Harrisburg, Pennsylvania to work on a Bessemer plant for the Pennsylvania Steel Company. It was there that Holley became associated with famed "Pennsylvania ironmen," integrating himself with what a historian of the American steel industry called the "group of five": John Fritz, George Fritz, Robert Hunt, William R. Jones, and Alexander Holley.[18]

The Fritz brothers, Hunt and Jones all worked for the

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[15] A contract between Holley and Henry Bessemer was finally signed on December 31, 1863. See McHugh, 191; and A Biographical Dictionary of American Civil Engineers, 62.

[16] The Troy plant would serve as an advertisement for the Bessemer process. Winslow & Griswold provided industrial tours (one of which was taken by Thomas Coleman in 1871), and literature pertaining to the facility, its cost, and its operation. Holley's labor and expertise as a consulting engineer was included with all contracts signed by prospective investors.

[17] McHugh, 190-195; and Allida Black, "Alexander Lyman Holley," in Iron and Steel in the Nineteenth Century, ed. by Paul Paskoff, Encyclopedia of American Business History and Biography, (New York: Bruccoli Clark Lyman, 1989): 166-168.

[18] McHugh, 216.

Cambria Iron Company of Johnstown, Pennsylvania, considered the country's premier training facility of iron and steel engineers during the second half of the nineteenth century.[19] Since the Cambria facility was going to roll the steel produced in Harrisburg, Holley worked closely with the engineers in Johnstown. It was a pioneering experience for all involved since no one knew the best way to handle steel rails. John Fritz, in particular, would revolutionize rail rolling with the development of the three-high rolling mill, the automatic roller driven table, and a hydraulic pusher to manipulate the metal through the mill.[20] These innovations were instrumental in the increasing mechanization and continuous operations which became the basis of the American steel industry.[21]

With his growing reputation, Holley received many offers to construct Bessemer facilities across the county. In September of 1872, Holley agreed to a contract (which included a $5,000 consulting fee and a yearly salary of $2,500), with Carnegie, McCandless & Company to build their planned Bessemer rail mill in Braddock, Pennsylvania. An 1872 article in The Engineering and Mining Journal announced the plans for the construction of the new steel works noting that "the completion of these works will form a new era in the manufacture of steel in Pittsburgh."[22] The formal opening of the mill was held on September 4, 1875, and as Jeanne McHugh has noted, "as records fell like clay pigeons, the steel industry entered a new era."[23]

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[19] John Fritz later went on to work for the Bethlehem Steel Company. For a concise history of the Cambria Iron Company see, Iron and Steel in the Nineteenth Century, 38-46.

[20] The three-high mill took the place of two-high mills which allowed for only one pass, after which the rail had to be moved back to allow for another pass, causing delay and excessive cooling of the metal. The use of three rolls, however, meant that reduction could be done on the reverse pass as well, resulting in a more uniform product and more continuous operations.

[21] Paskoff, 41-45.

[22] "New Steel Works," The Engineering and Mining Journal 14 (November 26, 1872): 346.

[23] McHugh, 258.

## Designing the Works

> *"He had taken a clean piece of paper on which he drew the railroad tracks first and then placed the buildings and contents of each buildings with primary regard to the facile handling of material so that the whole became a body shaped by its bones and muscles, rather than a box into which bones and muscles had to be packed."*[24]

On April 13, 1873 ground was broken for the new mill. Holley and his construction supervisor, Phineas Barnes, formerly of the Joliet Iron and Steel Company, Joliet, Illinois, put all their effort into maximizing the flow of materials through the mill. The project provided Holley with many advantages, from an engineering perspective, not found in other mills on which he had worked. Not only did the site offer vast space with both river and rail access, but it was to be developed solely as a Bessemer mill, and not a refitting of an iron works into a steel works. Historian Peter Temin noted that ET was Holley's favorite project because "he started from scratch and let form follow function."[25]

With ample rail access, Holley was able to incorporate existing lines into his design to facilitate the movement of materials and machinery. Although little has been recorded of the construction history of the mill, it is believed that the first structure built was a wharf along the Monongahela River near the mouth of Turtle Creek to handle river freight.[26] As noted above, the economic panic of 1873 slowed work on the mill, but also resulted in reduced costs as material and labor expenses dropped. A labor dispute at the Cambria Iron Works in 1873, furthermore, had a profound effect on the development of ET, as William R. Jones and many experienced workers left Johnstown to work in Braddock.

Jones was appointed chief assistant to George Fritz, superintendent of the Cambria works, in 1872. After Fritz's death in 1873, Jones was next in line to take over the superintendent's position, but was passed over by owner Daniel Morrell because of his attitudes toward labor. Jones was a

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[24] Memorial of Alexander Lyman Holley (New York: American Institute of Mining Engineers, 1884): 26.

[25] Temin, Iron and Steel in Nineteenth Century America, 172.

[26] L.C. Edgar, "History of the Edgar Thomson Works of the Carnegie Steel Company," Iron and Steel Engineer 5 (July 1928): 182; and "New Steel Works," The Engineering and Mining Journal 14 (November 26, 1872): 346.

staunch believer that in order to attain high productivity, high wages were necessary. As a result of this ideological split, Holley persuaded Jones to come to Braddock as his chief assistant during construction of the Edgar Thomson Works in 1873. On Holley's advice, Andrew Carnegie would later appoint Jones as general superintendent of the mill in 1875 under general manager William Shinn.[27] Because of his close relationship with the workers in Cambria, Jones was able to bring many of them to Braddock, supplying the new mill with skilled and experienced labor in all facets of steel rail production. The role of Jones in ET's extraordinary success can not be overemphasized. According to historian Larry Schweikart, Jones instilled a new "creative vision" in the men, teaching them to think about the daily operations of the mill and how they could be improved.[28]

Between 1873 and 1875, Holley and Jones worked hand-in-hand constructing the mill with the production of steel rails their foremost concern, and initiating many innovative, labor-saving devices. All buildings, except the rail mill and the gas generator house, were built of brick with iron roofs. Holley emphasized the need for an industrial architecture that suited the environmental conditions of western Pennsylvania, which necessitated an uninterrupted slope to the roof from the ridge to the eaves to shed rain and snow. According to Holley,

> These conditions require trusses of long span, but not necessarily of greater cost, as intermediate columns and their foundations are avoided. The absence of columns also facilitate the arrangement of machinery. The extreme variations of temperature require a mere shed in summer, and a closed building in winter. These conditions are best met by setting the roof on piers, rather than on a continuous wall. The openings are stopped, above by windows, and below by doors or by light panels, removable in summer. For ventilation, a number of light chimneys or lanterns of large diameter,

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[27] Larry Schwiekart, "William R. Jones," in Iron and Steel in the Nineteenth Century, ed. by Paskoff, 206-7. The entire command structure of Cambria eventually came to work at ET, including the heads of nearly all the departments, providing the catalyst for the mill's extraordinary successes. On a later tour of ET, Daniel Morrell remarked that, "I can see that I promoted the wrong Jones."

[28] Schwiekart, "William R. Jones," 208.

are found better and far cheaper than a continuous lantern roof.[29]

Workers who arrived at the mill in 1873 were kept on board wages until the return of economic stability. What tasks they may have done is unknown, but site preparation would have been a primary concern for Holley and Jones.[30] The construction of the mill required several outside contractors, many of whom were from Pittsburgh. Masonry work was done by Forrester & Alston; roofing and solid ironwork was completed by the Keystone Bridge Company (a Carnegie-owned venture); blowing engines and hydraulic cranes were manufactured by McIntosh, Hemphill & Company; the blooming train was built by James Moore of Philadelphia, Pennsylvania; all water works were completed by P.A. Worthington; Bessemer converters were built by Folten & Company; rotating machinery was built by Jackson & Miller of Detroit, Michigan; the rail saw was fabricated by H. Morris; boilers were supplied by the Pittsburgh Locomotive Works; and the Siemens heating furnaces were built by John Quinlivan.[31]

The majority of the structures on the site were built between the old Braddock Field plank road and the Baltimore and Ohio Railroad, except for a combined office/machine shop built north of the mill between the plank road and the Pennsylvania Railroad. The primary mill buildings were constructed on a southwest to northeast, forty-five degree angle to the rail lines which were parallel to the Monongahela River. The converting house, which was furthest to the west, measured 129' long x 84' wide x 30' high. Attached to the northeast of the converting house was a 107' x 44' x 46' cupola house, while a 54' x 48' x 36' blowing engine house, and a 46' x 80' bottom house were attached to the southwest side. The rail mill was located northwest of the converting department and measured 380' x 100', with iron roof trusses 20' apart set on 25' columns. A 100' x 35' wing off the northwest side of the rail mill contained the blooming mill. Between the rail mill and converting department was a 178' x 40' boiler house.[32]

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[29] Alexander L. Holley, "American Rolling Mills," The Journal of the Iron and Steel Institute 1 (1874): 348.

[30] Bridge, 79.

[31] This list comes from "The Edgar Thomson Steel Works--Formal Opening on the 4th Instant," The Iron Age 16 (September 16, 1875): 3.

[32] The Iron Age 16 (September 16, 1875): 3.

As American factories became increasingly complex and integrated, providing for their energy needs also became more complicated and costly. To fulfill these needs, the Edgar Thomson Works included numerous auxiliary structures and machines. To ensure continuous operations, there was a limited sharing of power sources so that a problem with one process would not shut down operations completely. Each converter, for instance, was equipped with its own blowing engine. The steam department for the works included sixteen boilers, each with its own 75' chimney.

The mill buildings were set back 1800' from the Monongahela River. A 46' x 54' pumphouse with a 20,000 gallon tank was located adjacent to the converting department to the southwest. Glazed pipes, laid below the lowest water level to insure a constant supply, transferred water from the river to the mill's well. Once pumped into the holding tank, water was supplied to all parts of the mill through a series of underground pipes set in brick tunnels for added accessibility. A duplex pressure pump provided power to the hydraulic machinery. Four cranes, the converter rotating mechanism, bottom cars, and lifts for the cupolas were all run by the mill's hydraulic machinery. A heating furnace plant, comprised of twenty gas producers heating six 8' x 20' Siemens furnaces, was used to reheat ingots before rolling.[33]

Iron, transported to ET from the Lucy furnace, was remelted in the three 5' diameter, 40' high cupolas at the converting department (there were also four spiegel cupolas 2' x 40'). Once remelted, the metal was cast into one of the rotated 5-ton converters, which would be turned to an upright position. After the blow was completed, the converter was rocked back to a pouring position, and the steel was poured into casting ladles. The charge from the converters was cast into 14" wide ingots, each weighing about a ton, on a railway car adjacent to the Bessemer plant. After crystallization, two men (with the help of a boy), would charge the ingots into reheating furnaces through the use of a peel (a long gas-pipe), and a chain fixed to a hydraulic piston. The ingot was drawn from the furnace by throwing a hook over it, and pulling it onto an ingot buggy by the same hydraulic powered chain. A laborer then guided the ingot buggy by hand down an inclined floor to the blooming mill.[34]

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[33] The Iron Age 16 (September 16, 1875): 5.

[34] The Iron Age 16 (September 16, 1875): 3; and Alexander Holley, "American Rolling Mills," 348-355.

Power feeding tables moved the ingot from the buggy to the 30" 3-high blooming train where it received between sixteen and eighteen passes to reduce a 14" ingot to a 7" bloom. A 3-ton hammer cut the bloom into three sections for rails, and further chipped the metal if necessary. The blooms were transferred to additional reheating furnaces located north of the rail mill, from which they were placed on the rail mill feeding tables. As Holley explained, "The rails lie always longitudinally with the building, and pass straight out at its end, the only lateral movement being across one of the short hot-beds and cold-beds."[35]

The 23" 3-high rail mill included three stands of rolls capable of rolling 30', 60-65 pound rails in less than two minutes, through a total of fifteen passes. Six workers at each stand (three to a side), used hooks to catch the rail as it passed through the rolls, and transferred it to the next pass. The mill was capable of turning out 200 tons of rails every day.[36] The first commercial rail was rolled on September 1, 1875, and by the end of the year 5,853 gross tons were produced. During its first full year of operation in 1876, ET manufactured over 32,000 tons of rails.[37] In 1877, Jones patented an automatic driving table that mechanized the feeding of rails through the passes, doing away with the "hook-and-tong" workers. This early innovation signaled the direction the mill was to proceed as increasing mechanization and continuous processes greatly increased output and reduced costs, but also severely undercut the position of labor.

## The First Twenty-Five Years

Despite the fact that between 1870 and 1880 the output of steel rails nationwide increased thirty fold, not all ventures were successful. Increased demand did not translate into increased profits for all rail producers. Historical evidence points to the operation of the mills as the key to success.[38] Of primary concern for the Edgar Thomson Works was cost accountability. The basis of this system was a belief that the only way to reduce costs was to know the costs. General Manager

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[35] Holley, "American Rolling Mills," 350.

[36] Ibid.

[37] The total yearly output of the Edgar Thomson Works between 1875 and 1889 is listed in "Annual Production of Rails by the Edgar Thomson Works," Iron Age 73 (April 14, 1904): 18.

[38] Temin, Iron and Steel in Nineteenth Century America, 172-74.

William P. Shinn initiated two accounting innovations he learned during his days in the railroad industry. These innovations included a system of rebates paid by the railroads for any operation that facilitated the transport of goods. For example, if material handling equipment at the Edgar Thomson Works aided the Pennsylvania Railroad in loading a shipment of rails onto a car, then the mill would share in the added economy through a rebate. Shinn also initiated a voucher system in which a detailed account of all costs had to accompany all orders before those orders were accepted and paid. Similar accounting measures also applied to internal construction projects, despite the protests of workers who saw them as petty intrusions into their daily activities.[39] Such measures helped ET record profits of $181,000 on a $731,000 investment in 1875, and $1,600,000 on a $1,250,000 investment in 1880. Throughout the nineteenth century, ET consistently recorded the lowest costs and highest profits in the industry.[40]

According to economic historian Peter Temin, a primary reason for ET's profits was the relatively small number of firms in the industry at the time. In 1875, a consolidation of Bessemer steel producers organized the Bessemer Steel Association to set the output and price of rails, effectively restricting entry into the steel rail market. While such "pools" were common in the late nineteenth century, they raised fears among consumers of monopolistic tendencies and increased prices. As a newcomer in the industry, ET was originally given the smallest share of the market, but the efficiency of the mill and Carnegie's opposition rendered the pool inoperable. A new agreement in 1877 established a more effective check and balance system between the eleven members, and instituted fines for producers who violated the pool. The agreement also established the Bessemer Steel Company, Ltd., comprised of all eleven mills, to buy and control Holley's patents to the Bessemer process.[41] An editorial in Iron Age responded to the agreement by stating,

> There are but eleven Bessemer mills in the country. They own absolutely all the patents essential to the manufacture of their products. Put the price where

[39] Bridge, 84-85.

[40] Larry Schweikart, "Carnegie Steel," in Paskoff, ed., Iron and Steel in the Nineteenth Century, 75.

[41] Temin, 174-176; and Kenneth Warren, The American Steel Industry, 1850-1970: A Geographical Interpretation (Oxford: Clarendon Press, 1973): 88-108.

> they choose, the only competition will be among themselves, for no other mill can be started in opposition to them.[42]

The effectiveness of the rail pool has been questioned since stability in the price of rails did not occur until the 1890s. The initial effect of the pool was to limit output through its restrictions on new ventures. (The development of two other regional steel mills, the Homestead Works and the Duquesne Works, attest to the problems facing companies outside of the rail pool. Both were unsuccessful in breaking into the market and were subsumed under the growing holdings of Andrew Carnegie.) Although the price of rails dropped from $60 a ton to $40 a ton in 1877, ET was able to turn a profit because of the efficient operations and high productivity of the mill under Jones.[43]

In 1878, the original converters were replaced by two 7-ton vessels, and the 30" blooming train was enlarged to a 32" train. Daily capacity was increased to 300 gross tons of ingots and 250 tons of rails and billets. The efficiency of the rail mill and the increasing capacity of the Bessemer converters prompted ET officials to formulate plans to construct ironmaking facilities. In 1879, the first blast furnace was constructed in Braddock. Under the direction of Julian Kennedy and later James Gayley, the Edgar Thomson furnaces revolutionized ironmaking with the hard-driving process.

Blast furnaces in the eighteenth and early nineteenth centuries were generally charcoal-fueled masonry structures built in the shape of a truncated pyramid, often by the side of a hill to facilitate the loading of charcoal, iron ore, and limestone. A blast machine, usually powered by water, supplied the necessary blast of cold air which increased the combustion rate of the fuel to begin conversion. As a flux material, limestone would bind to impurities in the iron ore creating the waste material slag. The remaining material was molten iron, which was cast into sand molds at the base of the furnace. By the mid-nineteenth century furnaces were larger, and often utilized steam engines and hot

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[42] <u>Iron Age</u> (November 8, 1877): 15.

[43] William Hogan, <u>Economic History of the Iron and Steel Industry in the United States</u> Volume 1, (Lexington, MA: D.C. Heath and Company, 1971): 99-100.

blast technology which increased the output of iron and lowered fuel costs.[44]

Initially, hot blast technology did not have a major impact upon the output of furnaces since it was not considered safe to push furnaces beyond their rated capacity.[45] It was not until the advent of the "hard-driving" process, which increased the blast rate by blowing more cubic feet of air into the furnace per minute, that furnace output began to increase rapidly. The lag between hot blast development and hard-driving was related in part to fuel. Because it burned at a lower temperature, anthracite coal was unsuitable as a fuel source for hard-driving furnaces. Coke, a form of distilled coal, proved to be the ideal fuel source for blast furnaces in the late nineteenth century.[46] The shift to coke had a tremendous impact upon western Pennsylvania. The Connellsville district of southwestern Pennsylvania contained bituminous coal fields well suited for coke-making. Lower shipping costs and a rail-based distribution system was a major factor in Pittsburgh's rise as the preeminent iron and steel center.

The hard-driving process began with the construction of the first blast furnace at the Edgar Thomson Works under Julian Kennedy in 1879. Furnace A, as it was called, was rebuilt from the remains of a small charcoal furnace built by Andrew Kloman in Escanaba, Michigan. Blown in during January of 1880, Furnace A was 65' tall, with a 7'-1" bosh. Despite the fact that its working volume was little more than half of the Lucy furnace, Furnace A's output was three-quarters that of Lucy. Kennedy attained such an extraordinary output by blowing 15,000 cubic feet of air into the furnace, twice as much as was common for a furnace with a 6,396' volume.[47] During its first week of

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[44] The technology of hot blast furnaces was developed in 1840 by David Thomas. The discovery had a tremendous impact upon the mineral utilization of iron-making blast furnaces. Hotter blasts necessitated the movement away from charcoal as the primary fuel to coal, and later coke.

[45] E. C. Potter, "Review of American Blast Furnace Practice," American Institute of Mechanical Engineers 23 (August 1893): 370-382.

[46] Temin, 158.

[47] Larry Schwiekart, "Julian Kennedy," in Paskoff, ed., Iron and Steel in the Nineteenth Century, 223; Bridge, 87-88; and Hogan: 1, 213.

operation, Furnace A produced 442 tons of pig-iron at a coke rate of 2,140 lbs. per ton of iron. By the spring of 1880, Kennedy was able to increase output of the furnace to 671 tons a week at a coke rate of 1,945 lbs. per ton of iron.

On April 4, 1880, Furnace B, based upon an original design by Kennedy, was blown in. Furnace B was 80' high, with an 11' hearth and an 20' bosh, and built with straight hearth walls. This innovation in design increased the combustion space within the furnace and further reduced fuel consumption. By May 1880, Furnace B was producing 3,718 tons of pig-iron every month, a notable and spectacular achievement in the iron industry. Directed by Kennedy between 1879 and 1885, the Edgar Thomson furnace plant continued to set and break its own production records with continual adjustments to the hot blast stoves, the blowing engines and furnace linings.[48] The furnaces were constructed in a row parallel to the Monongahela River just south of the Baltimore & Ohio Railroad lines. The integration of ironmaking and steelmaking facilities through the direct-process in 1882, further economized operations at ET.

The construction of a blast furnace plant, the replacement of 5-ton converters with 7-ton converters, and constant adjustments to the rail mill continually increased the monthly output of the works. In 1881 ET was producing 3000 to 3400 tons of ingots every week, and plans were announced to replace the existing converters with three 10-ton converters. Jones noted that the major obstacles to further increasing output were the constant repairs to the mill (including the relining of converting vessels), and the delay in moving ingots from the converting house to the blooming mill. Addressing the Iron and Steel Institute in London in 1881, Jones stated that after a series of repairs lasting but a few months, workmen were often rusty and required four to six weeks to regain the skill they had prior to the shutdown. Jones also noted that after a new innovation was instituted,

> the workmen are generally exceedingly slow to admit their usefulness, and are apt to follow their own judgements, which are generally founded on prejudice,

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[48] In the mid-1880s, James Gayley took over the superintendent's position held by Julian Kennedy, who became general superintendent of the Homestead Steel Works. Gayley also initiated several technological innovations which greatly increased the efficiency of the blast furnace plant, notably, the development of water-cooled bronze furnace plates which protected and extended the life of the furnace's refractory lining.

> so that instead of making an earnest effort to test the true merits of an improvement, they are apt to throw obstacles in its way.[49]

Jones' address to the institute also established his ideology of labor and technology when he stated,

> In increasing the output of these works, I soon discovered that it was entirely out of the question to expect human flesh and blood to labour incessantly for twelve hours, and therefore it was decided to put on three turns, reducing the hours of labour to eight.[50]

Jones was equally aware of the effects of increasing production speed on machinery, calling for manufacturers of mill engines and equipment to carefully design their products with only the heaviest millwork available. In response to critics (mainly from Europe), who claimed that the speed of American mills reduced the quality of steel, Jones stated,

> It is impossible to attain great speed in working while making bad steel. The pig metal must be good, the machinery in proper order, the ladles in good condition, the pouring clean, and the heats regular; in fact, during fast running the whole plant must work in harmony, and the operations must be efficiently conducted.[51]

Speed of production, according to Jones, forced workmen to focus upon their tasks and the condition of the machinery in order to attain a consistently high output of quality steel. The diversity of the workforce, furthermore, added to the mechanical advantages found in American works. In 1881, Jones reported that ET employed workers from England, Ireland, Scotland, Wales, Germany, Sweden, Hungary, France and Italy. "The mixture of races and languages seems to give the best results, and is, I think, far better than a preponderance of one nationality."[52] It is unclear whether Jones supported diversity because of the

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[49] W.R. Jones, "On the Manufacture of Bessemer Steel and Steel Rails in the United States," Journal of the Iron and Steel Institute 1 (May 1881): 129-131.

[50] Jones, (1881): 136.

[51] Jones, (1881): 137.

[52] Jones, (1881): 134.

widely held belief that it inhibited unionization. Jones' description of the ethnic characteristics of the workers, however, is significant in the context of the region's changing cultural milieu.

During the 1870s and 1880s, just as the Edgar Thomson Works was emerging as a significant industrial venture, Pittsburgh was experiencing a cultural transition as a city. The old immigrant stock of German and Anglo lineage was part of Pittsburgh's craft based economy characterized by small scale manufacturing. With the advent of mass production and large scale manufacturing during the late nineteenth century, an industrial culture developed that altered the city's social systems. Central to this change was the influx of "new" immigrants from southern and eastern Europe who transformed the everyday life of new industrial communities such as Braddock.[53] It was generally accepted that the promotion of industry--despite the consequences to both working and living conditions--was a worthy, and even expected pursuit of communities in the region.

The technology, labor, and speed of production that Jones described in his address to the Iron and Steel Institute concerned the Edgar Thomson Works, but encompassed more significant changes on a regional and even national scale. Jones' decision to institute a three-shift, eight hour day was based upon his belief about the relationship between technology and labor. While he was often the first to initiate labor-saving innovations which displaced workers, Jones was considered a spokesman for labor rights. These beliefs challenged the commonly held notions of the mill owners, including Carnegie, who saw labor as just another cost which needed to be reduced.

Throughout the 1880s, new procedures were initiated which reduced the number of skilled workers at the Edgar Thomson Works. Two important changes were the installation of the direct process in 1882, by which hot iron was moved from the blast furnaces to the converters without reheating in cupolas, and the installation

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[53] There has been much scholarly research on the transformation of Pittsburgh during the late nineteenth century. For example, see Francis Couvares, <u>The Remaking of Pittsburgh: Class and Culture in an Industrializing City, 1877-1919</u> (Albany: The State University of New York Press, 1984); Samuel P. Hays, ed., <u>City at the Point: Essays on the Social History of Pittsburgh</u> (Pittsburgh: University of Pittsburgh Press, 1989); and Susan J. Kleinberg, <u>Shadow of the Mills: Working-Class Families in Pittsburgh, 1870-1907</u> (Pittsburgh: University of Pittsburgh Press, 1989).

of natural gas into the production process in August 1884. Combined, these actions led to the reduction of over 600 workers at ET. In 1884, the first lodge of the Amalgamated Association of Iron and Steel Workers was established in Braddock to unionize the works.[54] The following year employees were forced to take a 10-15% pay reduction based upon the company's arguments that improved production methods required a restructuring of the wage scale.[55]

During the mid-1880s, innovations in the rolling of rails transformed ET's site plan with the construction of a new rail mill in 1886-1887. Jones began to design the mill in 1885 after he and R. W. Hunt, who was working in Troy, New York, received a patent for a new rail train. The technology was an extension of Hunt's development of power-driven roller tables which increasingly mechanized the process of feeding the rolls and moving the product through the mill. At ET, Jones built automatic tables both behind and in front of the roll trains in 1884, reducing the number of workers required to roll rails from fifteen to five.[56] With the increasing capacity of the blast furnace plant and Bessemer converters, the next logical step was the construction of a new rail mill, to be the most modern in the world.

The new rail mill was constructed parallel to the river and rail lines just west of the old rail mill. It incorporated the existing 32" blooming mill and chipping hammer to reduce the steel before entering the blooming (reheating) furnaces, each equipped with automatic charging and drawing machines. The reheating of the blooms became almost continuous as the material passed through the furnaces on its way to the first roughing train of the rail mill. Jones' design divided the common three-high mill into three separate sections, two roughing and one finishing. Moving linearly through the mill, the blooms received

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[54] For discussions of the labor movement in the steel industry see John Fitch, The Steel Workers (New York: Russell Sage Foundation, 1911); David Brody, Steelworkers in America: The Nonunion Era (Cambridge: Harvard University Press, 1960); and Paul Krause, "The Road To Homestead," (Ph.D. Diss. Duke University, 1987).

[55] Iron Age 35 (February 1885): 23.

[56] Samuel T. Wellman, "Four American Rolling Mills," Iron Age 58 (December 10, 1896): 1128; and Robert Hunt, "The Evolution of American Rolling Mills," Transactions of the American Society of Mechanical Engineers 13 (November 1891): 45-69.

five passes on the first roughing train, five passes on the second roughing train, and one pass on the finishing train. The first two 24" trains were three-high, each powered by an independent 46" x 60" steam engine. The 24" finishing stand was a two-high train powered by a 30" x 48" steam engine.

The operation of the mill was nearly automatic. An individual workman used levers to control the tables, the hydraulic lifts, and the hydraulic manipulator which turned the blooms as they entered the roll stands. Each stand, furthermore, was equipped with its own hydraulic crane to change rolls. The mill was capable of rolling a 30' rail in twenty-seven seconds. The finishing department of the mill was equally automated with reversing engines which allowed for the forward and backward movement of the rails, and steam cylinder and piston controlled arms to move rails from the hot beds to the cold beds.[57] After finishing, rails were pushed out the side of the building onto loading beds set below the level of the building to facilitate the loading of shipping cars. A representative of Iron Age who viewed the mill noted that,

> The whole arrangement is a radical departure from all former types, and it needs only a glance at the never ceasing procession of blooms entering at one end and of finished rails passing the saws to appreciate the enormous capacity of the plant.[58]

The new rail mill had a rated capacity of 1000 tons of finished rails a day, but many observers believed the mill could produce up to 1500 tons. Such a capacity concerned many who believed that the new rail mill would overbalance the steelmaking capacity of the plant.[59] At the time of the construction of the rail mill, no changes were made to other parts of the works. By 1890, however, an additional 10-ton converter was installed, and by 1895 the 10-ton converters were replaced by four 15-ton converters as the capacity of the mill continued to rise.

In addition to speed, economy and capacity, a primary

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[57] "The Edgar Thomson Rail Mill," Iron Age 43 (July 1, 1886): 1, 17; Carnegie Brothers & Company, The Edgar Thomson Works and Blast Furnaces (Pittsburgh: Joseph Eichbaum & Co., 1890), 23-28; and Hunt, "The Evolution of American Rolling Mills," 58-59.

[58] "The New Edgar Thomson Rail Train," Iron Age 42 (September 27, 1888): 462.

[59] Ibid.

concern for Jones was the quality of Edgar Thomson's steel in comparison to steel made by the increasingly popular open hearth process. With the initiation of the direct process in 1882, a batch of iron from an individual blast furnace was transported directly to the steel works without casting. Since each batch varied in chemical composition, varying grades of steel were produced in the Bessemer converters. The desire for a more uniform product prompted Jones to design a hot metal mixer, perhaps his most notable and lasting achievement. Put into operation in 1888, the Jones mixer was a relatively simple mechanism designed to equalize the iron before transport to the converters by mixing batches from many different furnaces in an iron, box-like structure.

The mixer plant was located just to the south of Furnace A, along the "direct process track," a narrow gauge rail line that connected the blast furnace plant with the converting department. Comprised of two, 17'-6" X 11'-3", 100-ton mixers, the plant was designed to receive, hold, and pour molten iron. An elevated track provided access to the top of the mixers. Six cars with 10-ton ladles filled by different furnaces were pulled by a locomotive to the mixer plant and emptied into a large hopper at the top of each mixer. Equipped with a 12" X 30" double reversing engine, each vessel was rocked to mix the iron. Ladle cars located in front of the mixers were filled with iron from both mixers to further insure a uniform batch. The ladles were then transported to the converters over the "direct process track."[60]

Not only did the Jones mixer create a higher quality product, but it did away with the manual casting of iron in sand molds located at the base of the blast furnaces. It furthered the trend toward continuous operations through more efficient movement of the material, while reducing the number of workers in the blast furnace plant. The increasing mechanization of steel technology, highlighted by the new rail mill and the Jones mixer, prompted Carnegie and ET's other managers to reconsider the current labor policy. As David Brody has written, in the case of the Edgar Thomson Works, "men no longer kept pace with machines."[61] Consequently, in December 1887, Carnegie decided to return to the twelve-hour day with a sliding wage scale based upon the average price of rails during the preceding month.

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[60] Carnegie Brothers & Company, 17; and "Pig Iron Mixer," American Manufacturer And Iron World 44 (June 7, 1889): 1.

[61] Brody, 36.

Employees were given a percentage of the average depending upon their work.[62]

From January to April of 1888, the Edgar Thomson Steel Works was closed by a strike organized by the Amalgamated Association and the Knights of Labor against the return of the twelve-hour day and the new sliding wage scale. Despite attempts by Jones to encourage workers to return to the mill, the union rejected all offers proposed by the mill's management. On April 20, 1888, Carnegie decided to end negotiations with the unions and began to hire non-union replacement workers.[63] By May 2 there were four furnaces in operation, and the first rail was rolled on the new, state-of-the-art rail mill. As a result, the Knights called off the strike on the following day.

During this contentious period in Braddock's history, Carnegie dedicated his first public library to the community in March of 1889. The combined library, store, and recreation center was part of an emerging corporate welfare landscape that would eventually include community swimming pools and playgrounds. Such paternalistic actions were not received well in the town, as labor leaders complained that Carnegie should be more concerned with conditions in his mills, than with monuments to his own name.

On September 26, 1889, William Jones was helping to fix a "hanging" furnace when it exploded, sending him onto the rail tracks below. Two days later Captain Jones died, ending an era in the history of the Edgar Thomson Works. Over 10,000 people attended his funeral in Braddock.[64]

After the death of Jones, Charles Schwab became the general superintendent of both the Edgar Thomson Works and the Homestead Works. Schwab began his career at ET as a engineer's helper in 1880, and became superintendent of the Homestead Works in 1887. With the death of Jones, Schwab inherited a modern, integrated steel works widely considered the jewel of the American steel industry. He continued Jones' management policies of scraping old equipment as soon as new technologies emerged to further modernize and increase the capacity of works. The total area of the mill had grown to 160 acres, with over fifteen acres covered

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[62] Ibid; and Carnegie Brothers & Company, 8-9.

[63] Iron Age 41 (April 26, 1888): 710.

[64] William Serrin, Homestead: The Glory and Tragedy of an American Steel Town (New York: Random House, 1992): 53.

by buildings. There were 3,500 employees creating about ten miles of rails (over 1,000 tons) a day. The daily consumption of water alone was over twenty-five million gallons.[65]

An 1890 inventory of the Edgar Thomson Works included the following: nine blast furnaces, operated as four separate plants of two furnaces (with Furnace A producing spiegel and ferromanganese exclusively), each equipped with Siemens-Cowper-Cochrane stoves; two stock yards measuring 1,280' X 60' and 368' X 100'; a Gates Mastodon Crusher to process limestone; a metal mixer plant comprised of two Jones mixers and platform scales; a steel department with four 10-ton Bessemer converters, four hydraulic ladle cranes, a ladle house, and a bottom house; two hydraulic pushers to remove the ingots from the molds; nine ingot furnaces; a 36" blooming train; a three train rail mill and finishing department; a seventy-nine boiler steam department; an electric light plant with three Brush sixty-five light dynamos; and a general office building, laboratory, machine shop, pattern shop, drafting room, and other auxiliary buildings and machinery.[66]

In 1891, construction began on a new converting works reported to be "the largest and best equipped converting department of any steel mill in the world." The new department was constructed on the site of the old one, and contained four 15-ton converters capable of producing enough steel to supply the rail mill. A new cupola house was built to the south of the converting mill adjacent to Turtle Creek. To augment the new steel works, the 36" blooming mill was changed to a 3-high 40" blooming mill capable of rolling ingots over 22" thick. It was the largest blooming mill in the country at the time. More powerful engines were also incorporated into the rail mill, allowing it to roll rails heavier than eighty-five pounds per yard.[67] The annual capacity of the mill was increased to 535,000 tons of ingots rolled into 425,000 tons of rails and 1,000 tons of billets.

The quality of heavier rails caused concern for railroads during the end of the nineteenth century. Due to increased traffic and heavier loads, rails were wearing out quicker than previous years. It was believed that the problem was related to

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[65] Carnegie Brothers & Company, 1-10.

[66] Ibid, 10-35.

[67] "Important Improvements at the Edgar Thomson Plant," Iron Trade Review 24 (January 8, 1891): 6.

the treatment of the rails, rather than any metallurgical problem with the steel. During the rolling of heavier rails, the heads retained heat longer than the flange. This lack of uniformity in temperature while rolling caused problems in the stability of rails, particularly during the cold winters of the northeast. Julian Kennedy and Thomas Morrison, who became superintendent of ET after Schwab in 1895, developed a process to roll rails at a lower temperature, which included a significant re-engineering of the rail mill during December 1900.

The change involved constructing a special cooling table between the intermediate (second) and finishing train of rolls. The procedure involved laying the rails on their side so that the heat leaving the head of the rail would be absorbed by the flange. This relatively simple solution brought the rail to a uniform temperature before it received its finishing pass.[68] The implementation of the Kennedy-Morrison process required a three week shut-down of the rail mill.[69] It soon became the standard method for rolling heavy rails throughout the industry.

During the 1890s, ET experienced additional changes to its landscape. On July 11, 1893, a foundry was constructed on thirty additional acres east of the blast furnace plant along Turtle Creek. The foundry was the first to successfully produce iron ingot molds directly from molten metal. It was soon producing ingot molds for all the Carnegie mills in the Monongahela Valley. The following year a small brass foundry was built. The blast furnace plant was further modernized in 1897 when the country's first automatic skip hoist was built on Furnace F, and the following year Furnace B received the first electrically powered skip hoist.[70]

These technological and operational changes in the Edgar Thomson Works occurred amidst monumental changes in the organization of the growing Carnegie empire. A period of backward integration with the completion of iron-making capabilities was quickly followed by an extended period of vertical integration into raw materials, transportation systems, and competing ventures. On May 5, 1882, Henry Clay Frick

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[68] "The Kennedy-Morrison Rail Finishing Process," Iron Age 66 (December 20, 1900): 16-18.

[69] Iron Age 66 (December 6, 1900): 33.

[70] F.M. Hays, "The History of Carnegie-Illinois Steel Corporation," unpublished manuscript from Stan Brozeck, USWA Local 1219.

accepted an offer from Carnegie Brothers & Company which gave the steel maker a minority share in some of the richest coke fields in the world. Frick had begun his operations with fifty coke ovens in Connellsville in 1871, and by 1879 he was shipping over 100 rail cars full of coke to the iron and steel mills of Pittsburgh every day.[71]

The H. C. Frick Coke Company continued to increase its property holdings and output of high quality coke, providing Carnegie with an abundant supply of cheap fuel. Frick's influence in the Carnegie company also grew, and in 1887 he was brought into the company. By 1889, Frick controlled eleven percent of the company, and was elected president of the renamed Carnegie, Phipps, and Company. Frick was largely responsible for the extraordinary financial successes of the company throughout the 1890s, often at the expense of labor. With the death of Jones, for instance, who Frick saw as soft toward labor, Frick further reduced wages and curtailed union activity in all the Carnegie mills.

Despite his views toward labor, Frick was a shrewd business manager who oversaw the acquisition of the Duquesne Steel Works in 1890, a small Bessemer rail mill which developed a process for rolling rails directly without reheating.[72] (The Homestead Works was purchased earlier in 1883 and converted to produce structural steel, diversifying Carnegie's holdings.) In 1892, Frick consolidated holdings into the Carnegie Steel Company, Ltd., the largest steel company in the world capitalized at twenty-five million dollars. Frick also directed the construction of a railroad to connect all the Carnegie owned mills in the Monongahela Valley, and oversaw the purchase of vast iron ore reserves on the Mesabi Range from the Rockefellers. To transport the ore from the Great Lakes to Pittsburgh, furthermore, Frick purchased and renovated an old rail line, creating a link directly to the mills over the new Pittsburgh, Bessemer & Lake Erie Railroad in 1897. In response, Carnegie wrote the following to his associates, "...we are now secure in our ore supply, it was the only element needed to give us an impregnable position."[73]

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[71] Hogan, 1, 244; Serrin, 48-49; and Chandler, 266-69.

[72] Michael G. Bennett, "Duquesne, Pennsylvania: A Geographical and Historical Analysis of an American Industrial Landscape," (MA Thesis: University of Notre Dame, 1993).

[73] Hogan: 1, 249.

The organization and economy of the Carnegie company was truly spectacular. During the economic downturn of 1893, Carnegie directed his managers to run full, and invest heavily in rebuilding and modernizing the works. Like he did twenty years earlier, Carnegie expanded at a time when his competitors were unable to compete or keep up with him. In 1897 the rail pool collapsed, prompting Frick to drive the prices of rails down from $28 to $14 a ton to capture as large a share of the market as possible at prices no other producer could match.[74] As Kenneth Warren has shown, "This sparked off the exceptionally sharp competition which exposed to the full the increasing weakness of the east and the outstanding quality of the Carnegie organization."[75]

The Edgar Thomson Works was the backbone of the many successes of the Carnegie Steel Company. The technology and management of the mill during its first twenty-five years of operation, supported by the efficiency of the Carnegie organization, revolutionized the American steel industry. The market, however, was entering a period of transition. There was a gradual diversification of the market as the production of rails and Bessemer steel began to decrease in relation to structural, plate, and open hearth steel. With the formation of the United State Steel Corporation in 1901, the Edgar Thomson Works was subsumed within a colossus. Its fate, and the fate of the Monongahela Valley, became linked to interests that superseded the individual mills and the region. The accomplishments of ET and those who worked there during its heyday could not be erased. In 1904, Iron Age introduced a table citing the yearly production numbers of ET from 1875 and 1903 with a caption stating, "This table presents the most remarkable metallurgical record that has ever been printed."[76]

## The Edgar Thomson Works under U. S. Steel

In 1900, the Carnegie company was the largest industrial venture in the world, with twenty thousand employees and profits for the year over forty million dollars. Since 1898, however, the company saw other producers of finished steel products moving into the manufacture of semi-finished and raw steel products. This backward integration was a direct challenge to Carnegie's

[74] Brody, 5-6.

[75] Warren, 99.

[76] "Annual Production of Rails by the Edgar Thomson Works," Iron Age 73 (April 14, 1904): 18.

position as many companies began to cancel their orders with Carnegie Steel. As a result, Carnegie and Schwab made plans to move into the production of finished goods such as wire, rod, and tube. The prospects of a giant like Carnegie moving into the production of finished goods threatened other manufactures who feared Carnegie's superior organization. In December of 1900, New York financier J. Pierpont Morgan approached Charles Schwab to inquire about the possible sale of the Carnegie Steel Company.[77]

Since the 1860s it had been Carnegie's intent to retire from industry while he was still healthy to focus upon philanthropic activities. After being informed by Schwab about Morgan's inquiry, Carnegie wrote down the assessed value of his company's holdings. Morgan accepted the $480 million figure put forth by Carnegie without debate, and on April 1, 1901, officially announced the formation of the United States Steel Corporation, the world's first billion dollar corporation. Capitalized at $1.4 billion, the corporation controlled sixty-five percent of the American steel industry and employed 168,000 workers. Judge Elbert Gary was appointed chairman of the new corporation, and Charles Schwab became its first president.[78]

Pittsburgh contained the greatest concentration of U. S. Steel facilities, including the massive Edgar Thomson, Homestead and Duquesne plants. The corporation quickly expanded its holdings, streamlined its operations to remove redundant functions, and liquidated its obsolete facilities. Significant investments were made in railroads, boat lines, raw material properties, and the construction of new facilities. Of particular importance, two modern steelmaking plants were built on the Lake Michigan shore of Indiana (Gary), and in Duluth, Minnesota. These two facilities signalled a shift in capitalization of the American steel industry toward the Great Lakes region, closer to the ore supply and to midwestern markets.[79] Pittsburgh, once considered ideal for industrial development, was beginning to show signs of its piecemeal growth. Large mills, like ET, found it difficult to expand and integrate operations while crossed by railroad main lines, local transport was hindered by a complex web of competing rail lines, and there

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[77] Serrin, 115-120; and Temin, 189-191.

[78] Hogan, 1, 163-174.

[79] Hogan, 1, 484-490.

was little level space left along the rivers upon which to build.[80]

These problems were just beginning to emerge at the time of the incorporation of U.S. Steel. For the Edgar Thomson Works, however, 1901 would be another record-breaking year. On September 23, the works set a new record by casting 3,391 tons of ingots in one day, complementing a month when 74,400 tons of ingots were produced, the most in ET's history.[81]

As part of a trend to diversify its product base, a new 18" light rail mill was built in 1905. The new mill, known as No. 3 (No. 1 was the 1887 mill and No. 2 was the original 1875 mill), was the first electric-powered rolling mill in the country. The 580' X 43' mill included two continuous heating furnaces, connected to three 3-high trains, one 2-high train, hot saws, and finishing equipment. All tables, trains and machinery were powered by two 1500hp DC motors. The electrification of the rolling mill freed up space in the mill, giving the operator greater visibility of the steel through the passes. The use of electricity also proved cheaper than steam, and enhanced the flexibility and control of speed of operations, which led to a more uniform process.[82]

Additional innovations in power supply were made at ET in 1905 when the nation's first blast furnace gas-powered engine was installed. The 21'-3/4" X 30" Westinghouse horizontal tandem four cycle gas engine was connected to a 250KW generator that supplied current to the iron foundry. This movement to utilize blast furnace gas continued the following year when two blowing engines were installed at the blast furnace plant. Capable of blowing 25,000 cubic feet of free air per minute at eighteen pounds per square inch, the two engines were the largest in the country at the time of their installation.[83]

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[80] Warren, 134-138.

[81] "Breaking Records at Edgar Thomson," Iron Trade Review 34 (October 10, 1901): 36.

[82] E. Frielander, "Electric Driven Rolling Mills," Iron Trade Review 45 (July 15, 1909): 133; G.E. Stoltz, Iron and Steel Engineer 23 (December 1946): 61; and B. Wiley, "The Roll Motors of an Electrically Operated Rail Mill," The Electric Journal 3 (August 1906): 456-463.

[83] "Blast Furnace Gas Engine Development in the Pittsburgh District," Iron Age 77 (May 10, 1906): 1561.

Despite production records set in 1901, ET's early history within U.S. Steel was characterized by a decreasing overall output and an increasing diversification of products. Between 1906 and 1914 the domestic consumption of steel rails fell from 3,654,794 to 1,792,986 tons. Since most of the remaining demand was coming from western states, U.S. Steel shifted the majority of its rail capacity to the Chicago district. Because of reduced freight rates, rails manufactured at the Gary Works could be sold at $3 less a ton than rails manufactured in Pittsburgh. Consequently, the Edgar Thomson works began to manufacture billets in 1907, tie plates in 1909, and sheet bar in 1910.[84] Rail mill No. 1, which had been rolling standard sections, began to produce sheet bar, mill No. 3 continued to produce light rails, and mill No. 2 was idle. The rails ET did manufacture were sold primarily on the export market because of Pittsburgh's rate advantage to the east. By the second decade of the twentieth century, the Edgar Thomson Works was running at only fifty to sixty percent of its total capacity.[85]

In 1912, U.S. Steel announced plans to invest $8,000,000 into the modernization of the Edgar Thomson Works' steelmaking and steelshaping capabilities over a five year period. A new No. 1 mill was built to roll standard sections, while the old No. 1 mill was converted to the No. 2 mill and retooled for sheet bar production. In addition, it was decided to build fourteen open hearth furnaces at ET to meet the increasing demands for low phosphorous steel.[86]

The open hearth process was introduced into the United States at the Trenton Iron and Steel Company of New Jersey by Cooper and Hewitt in 1868. Their assistant, Samuel T. Wellman, was instrumental in the refinement of the process, although it did not come into wide commercial use until the 1880s.[87] An extension of the puddling process, open hearth technology involved the charging of iron into a rectangular bin lined with refractory brick. Utilizing regenerative stoves developed by William Siemens, open hearth furnaces, fueled by gas, forced heat over the bath to remove carbon from the iron over a period of six

[84] Hays, J-15.

[85] "Edgar Thomson Improvements," Iron Age 89 (June 13, 1912): 1490.

[86] "Edgar Thomson Improvements," Iron Age 89 (June 6, 1912): 1418, and 89 (June 13, 1912): 1490.

[87] Temin, 139.

to eight hours. The advantages of open hearth furnaces derived from their ability to remove phosphorous from the iron, their economy through the use of scrap steel, and the added control over the process.[88]

The debate between Bessemer and open hearth producers continued through the end of the nineteenth century, and culminated in the early twentieth century with many steel companies dismantling their converters in exchange for open hearths. In 1907, Iron Age acknowledged the displacement of Bessemer rails with open hearth rails, citing three primary reasons: the growing scarcity of iron ore suitable for Bessemer steel, the superiority of open hearth steel, and the lower cost of the open hearth process. Talbot also noted the greater durability of rails with a low phosphorous content, and less waste in the open hearth process.[89]

During construction of the open hearth plant, located east of the Bessemer plant, superintendent Charles E. Dinkey noted that plans for the furnaces were first established in 1895.[90] It is unclear, however, why it took another twenty years before the plans were acted upon. ET had been rolling open hearth ingots produced at Homestead since the early twentieth century, but the cost was too exorbitant to continue the practice. It was thought to be more economical to construct an open hearth plant at ET. Begun in November 1912, the open hearth building was 1230' long X 150' wide, with a 41'-6" wide lean-to extending along the entire northern side of the building. The building, designed by the American Bridge Company, contained fourteen stationary open hearths arranged in a single row, each with a rated capacity between 80 and 100 tons per heat. The total monthly capacity of the plant was around 70,000 tons.

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[88] The ability to remove phosphorous opened up ranges of high phosphorous iron ores which were seen as unsuitable for Bessemer Steel, while the use of scrap lowered the cost of open hearth steel. A major criticism of Bessemer steel was that the speed caused unknown problems to the steel which could not be monitored. The open hearth process alleviated these fears, and was thought to produce a higher quality product. Hogan:1, 222-223; and Temin, 145-152.

[89] Benjamin Talbot, "Open Hearth Rails: Reasons for their Displacement of the Bessemer Product," Iron Age 79 (February 28, 1907): 656-58.

[90] "Edgar Thomson Open Hearth Plant," Iron Trade Review 54 (January 1, 1914): 106-110.

In order to create a cooler working space, the charging aisle was elevated 17'-6" above the pouring, or casting floor. Both narrow and broad gauge tracks ran the length of each aisle to facilitate the movement of equipment and raw materials. The charging aisle included three floor-type charging machines designed by the Morgan Engineering Company, and two 75-ton ladle cranes designed by Alliance. On the casting floor, fourteen 6-ton Whiting Jib cranes controlled the pouring spout for each furnace, and three 175-ton ladles were utilized. Each charge was made up in a 1036'-6" long X 66'-3" wide stock house, with four 15-ton Morgan cranes (two with magnets and two with grab buckets). Interestingly, no hydraulic power was used to operate machinery; electricity was used exclusively. The open hearth plant, when it opened in 1913, also included gas producers, a skull cracker, a cinder recovery yard, a calcining plant, a mixer building, and a spiegel cupola plant.[91]

Extensive improvements were made to ET's rolling mills to complement the new open hearth plant, including the relocation and rebuilding of the blooming mill, and the construction of new finishing mills to expand the product line. The new blooming mill was opened on October 8, 1914, and included two stands of 48" rolls followed by three stands of 3-high 40" rolls. A pot car and dump transported ingots from the soaking pits to the 48" trains through which they received two passes. The mill was non-reversing, which necessitated the use of turntables at both ends of the train to move the steel back to the front of the train for another pass. After two passes, the metal was transported to the 3-high 40" trains where it was reduced into standard blooms, sheared, and sent to the reheating furnaces prior to further finishing. As part of U.S. Steel's safety program, the blooming mill was equipped with large cellars under the train to allow easy access to lifting tables, machinery, scale pots and slag pits.[92]

The new rail mill was built with four stands of rolls, three 3-high, and one 2-high. The 3-high trains included two roughing stands and one finishing stand, with a 2-high final finishing stand. Known as the new No. 1 mill, it was capable of rolling heavy rail sections up to 150 pounds per yard, splice bars, rod mill billets, and small blooms. A 800-ton bloom shear, built by the William Tod Company of Youngstown, Ohio, was placed between

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[91] "The Edgar Thomson Open Hearth Plant," Iron Age 93 (January 1, 1914): 43-47.

[92] "New Carnegie Mill Equipment at Bessemer," Iron Age 97 (January 20, 1916): 185-86.

the blooming and rail mills, and was capable of cutting six 4" x 4" blooms at one time. All the equipment was designed by the engineering department of Carnegie Steel, and the mill housings were designed by both McIntosh & Hemphill, and the Mesta Machine Company.[93]

The diversification of the Edgar Thomson Works can be seen in its production numbers for 1920: 1,380,000 tons of ingots (840,000 open hearth and 540,000 Bessemer), 710,000 tons of rails, 600,000 tons of blooms, billets, and slabs, 200,000 tons of sheet bars, 85,000 tons of splice bars, 180,000 tons of ingot molds and stools, 13,300 tons of gray iron castings and rolls, 1,600 tons of brass castings, and 75 tons of babbit metal. By the end of the 1920s, the mill's open hearth capacity was increased by nearly fifteen percent with the addition of two 100-ton capacity furnaces and the enlargement of the fourteen existing furnaces. New machinery was also developed to facilitate the movement of raw materials into the open hearth plant, and the removal of ingots from the furnace plant.[94]

During the late 1910s and 1920s there was also a movement to consolidate power and supply facilities within the mill site to meet the increasing demands of modern steelmaking. In the summer of 1916, a 200,000,000 gallon pumping station was built by the foot of 13th street to replace five smaller pumping stations throughout the works. Eleven years later, in 1927, the first of two centrally located power producing plants, known as the Sterling Boiler House, was constructed. The two plants were to take the place of seven boiler plants located at various points within the complex. The 328' long X 84' wide steel framed Sterling Boiler House contained a ground floor, firing floor, and fan floor. Eight B & W Sterling class 13 and class 40 boilers were arranged in a single row in the center of the building. Most of the boilers were designed to utilize either blast furnace gas, or coke as the primary fuel supply. A vertical skip hoist was incorporated into a gable end of the building to load solid materials.[95]

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[93] Ibid, 186-188; and John S. Unger, "Rail Manufacture," Yearbook (American Iron and Steel Institute, 1916): 93-101.

[94] "Addition to Edgar Thomson Works, Carnegie Steel Co.," Iron Age 111 (March 1, 1923): 64; and J.R. Miller, "Open-Hearth Materials at Edgar Thomson," Blast Furnace and Steel Plant 17 (August 1929): 1195-1197.

[95] R. D. Abbiss, "Recent Boiler Plant Installation at Edgar Thomson Works, Carnegie Steel Company," Iron and Steel Engineer

The 1920s, in general, was a period of exceptional growth for U. S. Steel, during which it invested over $700 million into its facilities and recorded some of its largest profits. There was an increased demand for sheet, plate, and structural steel for the automotive, appliance and construction industries. As mentioned above, the decade was also characterized by the ascendancy of the Chicago district as the steel industry shifted toward the location of its new primary customers. With the onset of the Depression in the 1930s, however, a severe contraction in the output of durable goods led to a marked decrease in the demand for steel. A ripple effect spread through individual steel mills and steeltowns nationwide as shutdowns and layoffs occurred on a regular basis.[96]

An exception to the trend was the development of hot strip technology which spurred the demand for sheet and tinplate products. The demand forced many steel producers, including U. S. Steel to invest in new facilities despite shrinking capital expenditures. In 1937, the Pittsburgh phase of this expansion began with the construction of the new Irvin Works in Dravosburg to include a 80" hot strip mill. As part of the $70 million project, the Edgar Thomson Works was singled out as the site for a new slabbing mill and expanded open hearth capacity to supply the Irvin Works with slabs.[97]

Designed by United Engineering and Foundry of Pittsburgh, the slabbing mill, with rated annual capacity of 1.5 million tons, was considered the largest of its kind in the world. Capable of rolling slabs 60" wide and between 5' and 30' long, the universal mill had separately driven vertical rolls (not geared to horizontal rolls as was the previous practice), automatic oil and grease mechanisms, and motor driven auxiliary units to avoid any hydraulic systems. A 5000HP motor powered the horizontal rolls, while a 3000HP motor powered the vertical rolls. All roll housings were designed to allow for the easy removal and replacement of rolls, and the substitution of flat rolls for grooved (i.e. blooms). Scales located on the receiving table automatically weighed ingots prior to rolling. A 1200-ton "down and upcut" shear, powered by two 350HP motors, was attached to a shuttle type shear table capable of opening to collect crops

(June 1927): 285-296.

[96] Hogan: 1, 878-885, and 1193-1200.

[97] Ibid, 1200-1205.

and allow for longer slabs to pass, and to close to accommodate short slabs.[98]

Two 115' wide X 364' long slab storage and shipping buildings were constructed on both sides of an existing hot metal trestle. Craneways connected both wings to allow for the movement of materials between the buildings by 30-ton cranes. To augment the new mill, sixteen additional soaking pits, built by the Amsler Morgan Company of Pittsburgh, were installed. Each pit measured 15' X 16' X 8'-4", and combined gave ET an additional 1.8 million ton heating capacity. A new innovation in the pits were three, double span automatic cover carriages to manipulate the sixteen self-sealing pit covers. The slabbing mill began operations on November 1, 1938. Concurrent with the opening of the slabbing mill, a new stripper building and mold conditioning building also went into service.[99]

America's entry into World War II in 1941 put increasing demands upon American steel production. Between 1941 and 1944, U.S. Steel alone produced an extraordinary 120.3 million tons of ingots. A concerted effort to expand capacity was engineered by the Defense Plant Corporation, a subsidiary of the Reconstruction Finance Corporation. As part of the DPC's plan to increase national pig iron capacity to 6,508,950 tons, three new blast furnaces were constructed at ET to replace furnaces A, B, and C. Renumbered 1, 2, and 3, each furnace had a daily capacity of about 1300 tons, and included new turboblowers capable of supplying 90,000 cubic feet of air per minute at thirty pounds of pressure.[100] The new furnaces were also equipped with automated control systems which provided operators exact recordings of all materials used to charge the furnaces.[101]

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[98] "Edgar Thomson's New Slabbing Mill," Iron Age 143 (February 9, 1939): 46-47; and "Modern Slabbing Mill," Steel 104 (February 20, 1939): 50-51.

[99] "New Pits Add 1,800,000 Tons Heating Capacity," Steel 104 (January 16, 1939): 27.

[100] "Five Companies to Built 11 New Blast Furnaces," Iron Age 148 (July 31, 1941): 69; and "Carnegie-Illinois Starts Second E-T Blast Furnace," Iron Age 152 (December 23, 1943):72; and "Furnace Blown In at Edgar Thomson Works," Blast Furnace and Steel Plant 31 (August 1943): 904.

[101] Bruce Tau, "Remodeling at "G" Furnace, Edgar Thomson Works," Blast Furnace and Steel Plant 29 (February 1941): 219-220.

In addition to the enhanced ironmaking facilities, two new Bessemer converters were constructed with a total capacity of 675,000 tons. Together, with additions to the Homestead and Duquesne Works, the ingot capacity of the Pittsburgh district was increased over twelve percent.[102] In 1941, furnaces J and K were dismantled to make room for a structural shop complex and new power station. Furnace K was dismantled and moved to U.S. Steel's Mingo Junction facility in Ohio, and furnace J was taken apart piecemeal and used to repair other stacks.[103] The structural shop, built between 1942-1943, included a fabricating shop, erecting shop, ladle shop, and car repair shop. The new power station No. 1 was a three-story, 210' X 190' structure containing three boilers and two Allis-Chalmers 25,000 KW turbogenerators that utilized the gasses from the new furnaces for fuel.

The expanded capacity in the Monongahela Valley during the late 1930s and 1940s put exceedingly high stresses upon the ability of steel mills to deliver a reliable power source where needed. Just as hot metal was being shared between facilities in the Valley, electrical current was passing from one mill to the next. Depending upon the application, two different electrical cycles were being used, the 25 cycle and the 60 cycle. After a review of current and future needs undertaken by the Carnegie-Illinois engineering staff in 1940-1941, the decision was made to install an electronic frequency changer on the Edgar Thomson mill site. The changer allowed the mill to interface the two different forms of electrical power in order to maximize the control and flow of electricity as needed. The concrete, brick and exposed steel-framed structure was designed to be unattended, and further integrated the mills in the Monongahela Valley.[104]

Despite the booming war years, and continued prosperity into the 1950s, the steel industry in the Monongahela Valley had been in decline, in relative terms to other regions, since the

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[102] "C-1 Will Build New Blast Furnaces; Bessemers," Iron Age 148 (August 7, 1941): 1043.

[103] "To Remove Two ET Blast Furnaces," Steel 109 (November 10, 1941): 35-36.

[104] F.W. Cramer, L.W. Morton, and A.G. Darling, "The Electronic Frequency Changer," Iron and Steel Engineer 22 (January 1945): 52-67.

1930s.[105] The uncertainties of a declining market was compounded by the initiation of smoke control ordinances in Allegheny County in 1949. As part of the smoke abatement campaigns of the Pittsburgh Renaissance, legislation limited the production of ferromanganese. Flue dust, a byproduct of ferromanganese production, had been continually emitted through blast furnace bleeder stacks threatening the air quality of the region. In 1963 and 1972, increasingly stringent federal regulations were enacted with both the Clean Air and Clean Water Acts, which greatly limited the ability of industries to discharge toxins into rivers and the atmosphere.

This legislative activity had a profound effect upon the Edgar Thomson Works, and all the steel mills operating nationwide as hundreds of millions of dollars were invested into new technologies to reduce hazardous emissions, and antiquated structures were demolished. In 1950, a sintering plant was constructed at ET to further reduce flue dust and ore fines, as part of U. S. Steel's program to recycle iron ore. The plant utilized heat to agglomerate iron-bearing particles from flue dust and ore fines, then reduced the temperature in a rotary cooler. The plant was designed to recover 400,000 tons of high grade ore yearly.[106] In 1958, U.S. Steel installed a wet gas scrubber on its open hearth plant at ET as part of its efforts to study the viability of different smoke control technology. The system involved cooling the gas and forcing it through a film of water to separate the solids from the gas. Once separated the solids were removed and the gas was contained in a thickener for further processing.[107] By the mid-1960s, ET was considered a marginal steel producer with just half of its open hearths in operation.[108]

Increasing legislation, in part, contributed to the decision

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[105] According to Kenneth Warren, the decline continued for another forty years because of the relative cheapness of expanding existing facilities, compared with building new ones, and the local supply of skilled and experienced workers.

[106] "Sintering Plant Started at ET Works," Blast Furnace and Steel Plant 38 (September 1950): 1039-1040.

[107] "Gas Scrubber to be Installed On Open Hearth Furnace," Blast Furnace and Steel Plant (October 1958): 1101-02.

[108] In 1966 the decision was made to curtail rail production at the Edgar Thomson Works, ending almost a century of glorified production. See Warren, 286-290.

to build a basic oxygen steelmaking plant at ET to replace the open hearth plant. Considered a more efficient and flexible steelmaking technology, the new facility was built to increase and stabilize ET's operating level. The first heat in the new plant was tapped on January 10, 1972. Containing two 220 basic oxygen vessels, with built-in pollution control equipment, the plant was constructed to the west of the blast furnace plant between Eleventh and Thirteenth Streets.

The basic oxygen process involved blowing gaseous oxygen through a lance set just above the charge of molten iron, scrap and flux to begin the carbon boil. Conversion usually took only thirty minutes, compared to the six to eight hours involved in open hearth steelmaking. Consequently, the process combined the advantages of both the Bessemer and open hearth processes.[109] Edgar Thomson's basic oxygen plant was the second built in the Monongahela Valley (the first was at the Duquesne Works). Its construction marked the gradual movement of the American steel industry away from open hearth furnaces, the industry work-horses during much of the twentieth century. By 1972, sixty percent of U.S. Steel's production was from basic oxygen furnaces.

In 1974, the workforce of ET had fallen to 2,400 employees, with an annual payroll of over $37 million. Despite the heavy investment into new processes and environmentally sound technologies in the 1960s and 1970s, the continued presence of U.S. Steel in the Monongahela Valley came into question. By the early 1980s, it became apparent that the region was facing a period of de-industrialization of monumental proportions.

## Edgar Thomson and the Deindustrialization of the Mon Valley

The factors which led to the deindustrialization of the Monongahela Valley are too involved to treat them properly in this paper. On a micro level, it was related to the effects of the nationwide economic crisis of the late 1970s and early 1980s on American steel production. On a broader level, however, industrial collapse was related to the decapitalization of the Pittsburgh district in relation to other districts since the 1930s, the increasing competition from foreign steel, the growing gulf between management and labor, and the general movement from an industrial to a service based economy. In 1983, U.S. Steel

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[109] "ET Nudges U.S. Steel into the BOP Years," U.S. Steel News 37 (May-June 1972): 2-3; "BOP Shop for E-T," U.S. Steel News 34 (January-February 1969): 6; and "Edgar Thomson Plant Enters Second Century of Steelmaking," U.S. Steel News 40 (July-August 1975): 2-4.

decided to close plants in the Monongahela Valley in order to recoup their losses through a large tax write-off on company assets.[110] Between 1980 and 1985 the number of steel related jobs plummeted from over 28,000 to 4,500.

The economic recession of the late 1970s and early 1980s led to a social and political fragmentation of Monongahela Valley. The decision to close plants created an antagonistic atmosphere as certain localities lobbied for the merits of their own steelmaking facilities. According to a plan established by U.S. Steel, the fate of individual plants "depended on many factors, including degree of obsolescence and cost of modernizing, the location of the plant vis-a-vis markets for its products, comparative production costs, and the status of labor relations." During negotiations in 1983, management made it clear that if all else was equal, towns that would "cooperate" with management would be favored.[111] The infighting between communities proved detrimental to the development of a region-wide plan to aid the social impact of de-industrialization.

One point of conflict was between the Duquesne plant and Edgar Thomson Works, over which would emerge as the Valley's only remaining raw-steel producing facility. Despite Duquesne's huge ironmaking capacity compared to ET, a decision was made to keep ET because of its more modern steelmaking plant. It was also decided not to run iron from Duquesne to Braddock because of the added expense and time involved.[112] Consequently, the Duquesne facility was closed completely in 1984, and the Edgar Thomson Works continues to manufacture steel. ET's future viability was extended with the decision to operate a continuous caster at the works.

Put into operation in the early 1990s, the continuous caster provided finishing mills with steel without the intermediate steps of the soaking pits and blooming mills. The basis of the process was the continuous casting of steel vertically through a funnel, or mold (usually made of water-cooled copper plate), which narrowly channeled the flow into an "endless" ribbon of steel in the shape of slab. Spray towers quench the steel,

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[110] For an in depth examination of the decline of American steel see, John Hoerr, And the Wolf Finally Came: The Decline of the American Steel Industry (Pittsburgh: University of Pittsburgh Press, 1988).

[111] Hoerr, 438.

[112] Hoerr, 441.

partially solidifying the mass as it is fed directly to the rolling mills. There are three basic advantages to continuous casting compared with ingot casting: savings from reduced heating and material handling, less waste in the form of scrap, and greater quality control by avoiding common defects in individual ingots.[113]

What the installation of a continuous caster will mean for the Edgar Thomson Works is not yet clear. What is evident is that the works continues to manufacture steel into its 120th year. The larger milieu in which ET operates has drastically changed over those years. Pittsburgh has actively transformed its image from a blue-collar, smoke and fire steeltown, to a high-tech, research oriented marketplace. The city has gone as far as scrubbing the soot off its more famous landmarks to erase the effects of years of rampant industrialization. The perceptions of the region as an industrial center, however, remain and flourish in American popular culture. And the old industrial communities still struggle with an aging population, a declining tax base, and acres of environmentally unstable riverfront property. Within this period of change, the Edgar Thomson Works is a point of continuity. Once a symbol of monumental change, it is now a reference to Pittsburgh's past.

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[113] Warren, 256-257; and Richard Preston, American Steel: Hot Metal Men and the Resurrection of the Rust Belt (New York: Prentice Hall Press, 1991): 91-102. The description of continuous casting comes from Preston's analysis of the Nucor caster in Indiana. While the idea is the same, a specific description of the Edgar Thomson caster was not found by the author.

**APPENDIX: EDGAR THOMSON WORKS SITE INVENTORY***

*This inventory of the Edgar Thomson Works was conducted during the summer of 1990 by Lynne Snyder, Michael Workman, and Joel Sabadasz. At the time, ET was an operational plant, and access to, and the photography of, several sites was limited. This inventory is therefore only partial.

**CONTENTS - EDGAR THOMSON WORKS SITE INVENTORY**

## IRONMAKING - BLAST FURNACE PLANT

| | |
|---|---|
| Historic Name: | U.S. Steel Corporation, Edgar Thomson Works, Blast Furnace Plant, No. 1 Ore Yard |
| Present Name: | USX Corporation, Edgar Thomson Works, Blast Furnace Plant, No. 1 Ore Yard |
| Location: | Runs parallel to the Blast Furnace Trestle |
| Construction: | 1898; with addition of Ore Bridges in 1941 |
| Documentation: | Photographs of the Blast Furnace Plant can be found in HAER No. PA-384-A. |

### DESCRIPTION

Constructed of brick walls, the 1000' long x 143' wide x 20' deep Ore Yard is laid out on an east/west axis. The Yards is used to stock iron ore, limestone, and gravel for use in the Blast Furnace Plant. Running along the inside southern wall of the Ore Yard is a raised trestle carrying one standard gauge railroad track. Hopper cars are singularly pulled up onto the trestle and positioned over one of two dumping points near the southeastern and southwestern corners of the Ore Yard where their contents are bottom-dropped into it. Two Ore Bridges, No. 1 and 2, straddle the width and travel along the length of the Ore Yard on narrow gauge railroad tracks. Each bridge is equipped with a trolley and 10-ton scoop bucket to transfer raw materials from the dumping area to segregated piles in the Ore Yard. The trolleys and scoop buckets also transfer raw materials from the Ore Yard to hopper cars stationed above stockhouse bins on the stockhouse trestle.

### HISTORY

The active Ore Yard was built in 1898, shortly after the steel industry's first successful application of the Ore Yard/Ore Bridge complex for raw materials storage and handling in blast furnace plants. This system was first developed at the Duquesne Steel Works, Duquesne, Pennsylvania. The current Edgar Thomson Ore Bridges were installed in 1941.

Sources:

Johnson, J.E. Blast Furnace Construction in America. New York: 1917, 15-16.

Sanborn Insurance Company. "Map of Edgar Thomson Works." New York: 1901.

"The Duquesne Furnace Plant of the Carnegie Steel Company, Limited." Iron Age 59(March 25, 1897): 4-11.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Blast Furnace Plant, No. 1 Trestle
Present Name: USX Corporation, Edgar Thomson Works, Blast Furnace Plant, No. 1 Trestle
Location: Fronting Blast Furnaces No. 1, 2, 3, 5 & 6
Construction: 1898; rebuilt in 1916; repaired in 1942, 1945, 1953, 1961
Documentation: Photographs of the Blast Furnace Plant can be found in HAER No. PA-384-A.

## DESCRIPTION

The No. 1 Stockhouse Trestle is laid out on an east/west axis, and is approximately 1000' x 35'. It is located adjacent to, and runs along the outside north wall of the Ore Yard. The trestle consists of a steel-framed platform that supports three parallel standard gauge railroad tracks. Rows of stockhouse storage bins are hung from the steel-framed platform below the tracks. Track No. 1, which runs along the northern edge of the trestle, is used for stacking coke bins; Track No. 2, running along the middle of the trestle, is used for stocking iron ore, limestone, dolomite, pea coke, or scrap. Track No. 3 is used as a spare. Hopper cars filled with coke are run directly onto track No. 1 where their contents are bottom-dropped into stockhouse coke bins. Iron ore and limestone are transferred from the ore yard by the ore bridges to hopper cars positioned on track No. 2 over their respective stockhouse bins. Hopper cars filled with dolomite, pea coke, and scrap are run directly onto track No. 2 over their respective bins.

## HISTORY

The Blast Furnace Trestle, first constructed in 1898, was part of a newly built automatic raw materials storage, handling, and delivery system. The trestle was rebuilt in 1916, and further repaired in 1942, 1945, 1953, and 1961.

Sources:
Sanborn Insurance Company. "Map of Edgar Thomson Works." New York: 1901

USX Corporation. "Data Sheet Referring to the History of Buildings and Structures at the Edgar Thomson Works." Braddock: 1990.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Blast Furnace Plant, No. 1 Stockhouse
Present Name: USX Corporation, Edgar Thomson Works, Blast Furnace Plant, No. 1 Stockhouse

Location: Below the Blast Furnace Trestle
Construction: 1898; rebuilt in 1916
Documentation: Photographs of the Blast Furnace Plant can be found in HAER No. PA-384-A.

## DESCRIPTION

Laid out on an east/west axis, the one-story high Stockhouse is approximately 100' x 35'. The structure has concrete walls and flooring. Its steel-framing and roof are provided by No. 1 Stockhouse Trestle. One double coke bin per furnace, each equipped with a weigh hopper and vibrating screen, is hung from track No. 1 near the southern wall of the stockhouse. A surge hopper and skip pit are located directly below each double coke bin. Coke is dropped from the bin into a weigh hopper where it is weighed and fed over the vibrating screen to separate the coke breeze from the full-sized pieces of coke. The full-sized coke passes over the vibrating screen and into a chute leading to a surge hopper. The coke breeze falls through the vibrating screen into a dust pocket before dropping onto a feeder conveyor which delivers it to a main coke breeze removal conveyor leading to discharge bins.

Raw material bins filled with iron ore, limestone, dolomite, pea coke, or ore scrap are hung from track No. 2, near the center of the stockhouse. A manually operated scale car, one per operating furnace (No. 1 & 3), rides on standard gauge railroad tracks directly underneath the raw material bins. The kind of raw materials, their amount, and the order in which they are to be charged into the furnace are relayed to the respective operators from the command centers of the plant's two operating furnaces through a control panel located on the scale car. Raw materials are dropped from the bins into one of the scale car's two weigh hoppers by the actions of the operator, who releases the materials from their respective bins by pulling down on the handle governing the opening of the bottom-opened bins. At Blast Furnace No. 3, the weight is automatically controlled by an electrical signal emanating from No. 3's computerized central command-control system of operational governance. After the proper amount of raw materials has been charged into the scale car, they are released through the bottom opening of the car's weigh hopper into surge hoppers located directly below. All raw material surge bins, including coke, are controlled by the scale car operator.

## HISTORY

The No. 1 Stockhouse, constructed in 1898, was part of a newly constructed automatic raw materials storage, handling, and delivery system.

Sources:
Sanborn Insurance Company. "Map of Edgar Thomson Works." New York: 1901

USX Corporation. "Data Sheet Referring to the History of Buildings and Structures at the Edgar Thomson Works." Braddock: 1990.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Ore Yard No. 2 and Ore Yard Breaker House
Present Name: USX Corporation, Edgar Thomson Works, Slag Pit, Ore Yard Breaker House
Location: 425' north of the Monongahela River, and 1,300' east of 11th Avenue, just east of the Structural Shop
Construction: 1906 for Ore Yard, 1979 for Slag Pit
Documentation: There are no photographs of the Slag Pit, or the Ore Yard Breaker House.

## DESCRIPTION

The Slag Pit measures 340' x 190'. It is approximately 20' deep and enclosed by steel pilings on the northeast, northwest, and southwest sides. The southeast side is open. A regular gauge track for slag cars and a steel frame wall enclosing water pipes for spraying run along the length of the northwest side on an embankment. Two abandoned grab buckets are located on the southeast side. The pit is currently used for dumping and cooling blast furnace slag.

The one-story Ore Yard Breaker House, located on the northwest side, measures approximately 16' x 16'. It is a common-bond, red brick structure with a sloped concrete roof. It contains breaker panels for the ore bridge and transfer cars.

A pedestrian tunnel, connecting the area northeast of the Structural Shop with the area north of the Blast Furnace Convenience Building, is located under the Slag Pit.

## HISTORY

No. 2 Ore Yard was installed in 1906 to serve Blast Furnaces "J" & "K". The two original ore bridges were replaced by a single one manufactured by Dravo in 1931. In 1943, as a part of the Defense Plant Corporation installations, a single "man-trolley-type" (one in which the operator rides on the trolley which carries the grab bucket, hoisting, and trolley traversing machinery), 11-ton capacity ore bridge was installed. The bridge was built by the American Bridge Company with man trolleys by

Heyl and Patterson. In 1979 the No. 2 Ore Yard was converted into a Slag Pit.

Source:

Heumann, G. W. and Raube, W. C. "Modern Ore-Bridge Installation." General Electric Review. 48(December 1945): 7-12.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Turbo Blower Building
Present Name: USX Corporation, Edgar Thomson Works, Turbo Blower Building
Location: 540' north of the Monongahela River, and 2050' east of 11th Avenue
Construction: 1927
Documentation: Photographs of the Blast Furnace Plant can be found in HAER No. PA-384-A.

## DESCRIPTION

The Turboblower Building measures 139'-6" x 90'. It is three-stories, and is 90' from the floor to the bottom chord of the truss. The foundation and main floors are concrete with some areas of terra cotta. It is a steel frame structure with common-bond, buff-colored brick curtain walls on the northwest and southeast sides, and corrugated metal covering the northeast and southwest walls. There are rectangular windows on the northwest and southeast sides on all three stories, each fitted with 4 x 4 sash. The roof is supported by Fink trusswork and covered with corrugated metal.

A steam-driven, Ingersoll-Rand, centrifugal turbo-blower is located on a platform on the second or blower floor. A spiral staircase connects the first floor with the blower floor. Cold blast piping and a surface condenser are located on the first floor.

Adjacent to the building on the northwest side is an approximately 16' x 12' one-story brick structure with an arched brick roof, known as the Car Packer's Shanty. It was last used to pack flue dust before delivery to the sintering plant.

## HISTORY

The Turboblower Building, when constructed in 1927, contained four turboblowers.

Source:

Carnegie-Illinois Steel Corporation. "Turbo-Blower Plant, General Arrangement." Drawing #B-1-29. March 26, 1927.

## OPEN HEARTH STEELMAKING PLANT

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Open Hearth Plant, Hot Metal Trestle
Present Name: USX Corporation, Edgar Thomson Works, Open Hearth Plant, Hot Metal Trestle
Location: 350' south of Braddock Avenue, 2150' east of Gate No. 2, and south of the Open Hearth Furnace Building
Construction: 1924
Documentation: A photograph of the Open Hearth Plant can be found in HAER No. PA-384-B.

### DESCRIPTION

The Hot Metal Trestle is an elevated, regular gauge track with side-boards, that runs from a starting point 350' south of the Cast House of Blast Furnace #1, just north of the Foundry Chipping Building, to the Mixer Building on the northeast side of the Open Hearth Furnace Building. It extends a distance of about 2,100'.

The trestle is approximately 20' above ground level and is supported by piers, most of which are constructed of concrete and have center arches. Other piers are structural steel. The ramps on the ends are made of brick.

### HISTORY

The Hot Metal Trestle was built in 1924 to transport hot iron from the Blast Furnaces to the Open Hearth furnaces for steelmaking. It was restructured in 1937 when the Slab Mill was built to pass over the production line. It was repaired in 1951 and 1953. The facility was abandoned, along with the Open Hearth Plant, in 1971 when the Basic Oxygen Process Shop was built.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Open Hearth Plant, Mold Conditioning and Hot Top Building
Present Name: USX Corporation, Edgar Thomson Works, Open Hearth Plant, Mold Conditioning and Hot Tap Building
Location: 350' south of Braddock Avenue, 2150' east of Gate No. 2, and south of Open Hearth Furnace Building
Construction: 1937
Documentation: A photograph of the Open Hearth Plant can be found in HAER No. PA-384-B.

## DESCRIPTION

The building is 1,375' x 140'. It is one story with a clerestory, and measures approximately 50' from the floor to the bottom chord of the truss.

The building is supported by steel columns that rest on concrete pillars. The floors are concrete. The east and west walls are open; the remaining walls are covered with corrugated metal sheeting fitted with louvers for ventilation. The monitor roof has a Fink (or Pratt?) truss, and is also covered with corrugated metal sheeting. There are four EOT cranes.

The facility is currently used for ingot mold conditioning for the BOP operations. In addition to the overhead cranes, there are several regular gauge tracks, and two hot-topping platforms. Stools are coated with a non-stick material on the east end of building. Hot tops, along with wood sideboards, are put-on the bottom-poured molds on the west end.

| | |
|---|---|
| Historic Name: | U.S. Steel Corporation, Edgar Thomson Works, Open Hearth Plant, Furnace Building |
| Present Name: | USX Corporation, Edgar Thomson Works, Open Hearth Plant, Furnace Building |
| Location: | 200' south of Braddock Avenue, 2400' east of Gate No. 2, and south of the Open Hearth Stockhouse |
| Construction: | 1912 |
| Documentation: | A photograph of the Open Hearth Furnace Building can be found in HAER No. PA-384-B. |

## DESCRIPTION

The building is 1,412' x 150' with a partially demolished, 41'-6" lean-to extending along the northeast elevation. It is one-story with a clerestory, and measures approximately 50' from the floor to the bottom chord of the truss. It is divided longitudinally by an interior row of steel columns, which formerly supported the furnaces, into a charging aisle, which is partially demolished, and a teeming aisle, which is intact. At the northwest end of the building under the Hot Metal Trestle is the Mixer Control Building, a remnant of the demolished Mixer Building. At the southeast end of the building is the dismantled No. 5 Foundry.

The building is supported by steel columns that rest on concrete pillars with interior concrete buttresses. The floors are dirt with some areas of concrete. The wall covering is corrugated metal sheeting, fitted with louvers for ventilation. The monitor roof has a Fink truss and is also covered with corrugated metal sheeting.

The Mixer Control Building is a 24' x 24' brick structure which contains a single-stage, electric air compressor and an oil lubrication system. Both were built about 1950, and were associated with the tilting mechanism of the hot metal mixer, formerly positioned above. The dismantled No. 5 Foundry contains only a few wood forms.

The facility has been stripped of steelmaking equipment. An Alliance ingot-stripper, designed for "sticker" ingots, but not successfully utilized at ET, rests in the northwest end of the building. The building is currently used for ingot mold cooling and conditioning. A regular gauge track, used to transport ingot molds, runs the length of the former charging aisle.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Open Hearth Plant, Open Hearth and Masonry Convenience Building
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Open Hearth Plant, Open Hearth and Masonry Convenience Building
<u>Location</u>: 180' south of Braddock Avenue, and 2300' east of Gate No. 2, between the Open Stockhouse and the Open Hearth Furnace Building
<u>Construction</u>: unknown
<u>Documentation</u>: A photograph of the Open Hearth Plant can be found in HAER No. PA-384-B

DESCRIPTION

The building measures approximately 200' x 25', and it is two stories tall. It is a buff-colored, common-bond brick structure with small rectangular window openings. The slightly sloped roof is coated with tar and gravel.

The interior is divided into locker rooms and bathrooms. The second floor of the building was formerly connected to the Open Hearth Furnace Building by an elevated walkway.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Open Hearth Plant, Stockhouse
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Open Hearth Plant, Stockhouse
<u>Location</u>: 100' south of Braddock Avenue, and 2400' east of Gate No. 2
<u>Construction</u>: 1912

Documentation: A photograph of the Open Hearth Plant can be found in HAER No. PA-384-B.

DESCRIPTION

The stockhouse measures 1,036'-6" x 66'-3" and is one story high. The foundation is concrete. The structure is steel-framed with most of the siding removed. The monitor roof is supported by a Fink truss and is covered with corrugated metal sheeting, some of which appears to be original.

The interior contains a narrow gage track and two EOT cranes. It is currently used to house and cut scrap for the BOP steelmaking operation. For this purpose there are hand-held acetylene/oxygen torches and a jig crane-type rig for burning large metal stock such as ingots.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Open Hearth Plant, Tar Pump House & Pits
Present Name: USX Corporation, Edgar Thomson Works, Open Hearth Plant, Tar Pump House & Pits
Location: 170' south of Braddock Avenue, and 3400' east of Gate No. 2, between the Open Stockhouse and Open Hearth Furnace Building
Construction: unknown
Documentation: A photograph of the Open Hearth Plant can be found in HAER No. PA-384-B.

DESCRIPTION

The building measures approximately 40' x 24', and is one story. It is a steel frame structure with corrugated metal siding. The gable roof is covered with corrugated metal and is equipped with two round ventilators. The interior is used for storage and is devoid of equipment.

The tar pits, formerly used to store tar used as fuel in the Open Hearth Furnaces, are currently being demolished.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Open Hearth Plant, Substation No. 2
Present Name: USX Corporation, Edgar Thomson Works, Open Hearth Plant, Substation No. 2
Location: 60' south of Braddock Avenue, and 2800' east of Gate No. 2, just northeast of Open Hearth Stockhouse
Construction: c. 1940s
Documentation: There are no photographs of Substation No. 2.

## DESCRIPTION

The building measures approximately 60' x 26' and is one story. It is divided so that there is a gable-roofed main building flanked on the northeast by a shed with a slightly sloped roof. The southwest corner of the main building is contoured or flattened, perhaps to conform to the lines of an earlier track or road. The structure has concrete floors and is constructed of common-bond red brick. The arched window openings have been infilled with brick. The gable roof is supported by Pratt trusswork with pinned connections. Both it and the shed roof are covered with corrugated metal.

The interior contains 25 cycle transformer equipment dating to about the 1940s.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, No. 1 Scrap Drop
Present Name: USX Corporation, Edgar Thomson Works, No. 1 Scrap Drop
Location: 475' south of Braddock Avenue, 2,050' west of Gate No. 2, and 90' northeast of the Slab Storage Building
Construction: 1937
Documentation: There are no photographs of the No. 1 Scrap Drop.

## DESCRIPTION

No. 1 Scrap Drop measures approximately 100' x 76' and is about 60' high. It is a steel frame structure covered with steel plate on the first 12' of the walls; the walls above are 1' x 1' wood beams, stacked horizontally between the steel columns. The foundation is concrete and the floors are dirt. There is no roof. A 45-ton Alliance crane is positioned on a craneway approximately 35' above grade level. A standard gauge track, connecting the Ingot Stripper and the Mold Conditioning Building, runs through openings in the north and south sides.

## HISTORY

No. 1 Scrap Drop, formerly the Open Hearth Scrap Drop built in 1912, was relocated from a location approximately 200' south of the present site in 1937 to make room for the Slab Mill. The building was demolished July 5 and 6, 1990, just a few weeks after this inventory.

Source:
Carnegie Steel Corporation, Edgar Thomson Plant. "History of Buildings." Tms., Clariton Map Room, Clariton Works.

## STEELSHAPING - ROLLING MILLS

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Roll Shop
Present Name: USX Corporation, Edgar Thomson Works, Roll Shop
Location: 150' south of Braddock Avenue, and 500' east of Gate No. 2
Construction: 1913
Documentation: There are no photographs of the Roll Shop.

### DESCRIPTION

The Roll Shop measures 215' x 70'-8". It is a one story building with a clerestory; it is 32' in height from the floor to the bottom chord of the truss. It is a steel frame structure with common-bond red brick curtain walls. The windows, some of which have been infilled with brick on the first floor and translucent fiberglass on the clerestory, are set in arched openings. The gable roof is supported by Fink trusswork with riveted connections, and is covered with corrugated sheet metal.

The interior contains no in situ machinery except a Morgan 25-ton EOT crane and a space heating system. It is currently used for spare parts storage.

### HISTORY

A 1913 drawing indicates that the Roll Shop originally contained twelve lathes.

Source:
Edgar Thomson Steel Works. "Mill Roll Shop, Brickwork." Drawing #1- 14-77. January 23, 1913.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, No. 2 Mill
Present Name: USX Corporation, Edgar Thomson Works, No. 2 Mill/44" Slab Mill Spares
Location: 320' south of Braddock Avenue, and 750' east of Gate No. 2
Construction: 1915
Documentation: All photographs of the 44" Slabbing Mill can be found in HAER No. PA-384-D.

### DESCRIPTION

The No. 2 Mill measures approximately 675' x 80'. It is one story and about 40' from the floor to the bottom chord of the truss. It appears that the south side of the building, bordering the Langenfelder slab processing works, has been partially dismantled, and a lean-to or annex has been removed.

The structure is composed of a steel frame covered with corrugated metal sheeting. In some areas there are red-brick, common-bond walls, some extending to the level of the craneway. The columns are built upon concrete foundations. The floors are concrete, with some areas of dirt. There are no windows, and some of the doors are arched-shaped. The monitor roof is supported by Fink trusswork and covered with corrugated metal sheeting.

The building is divided into two parts. The larger, west end is laid-out for storage. Parts for the 44" Slab Mill are positioned in racks and on the floor in this section. The east end is used by the contractor, Langenfelder, in their operations.

HISTORY

The No. 2 Mill was built in 1915. It rolled rails, splice bars, sheet, and tin bar from 9-1/2" square steel blooms. It had an annual capacity of about 492,000 tons.

<u>Sources</u>:

Carnegie Steel Company, Edgar Thomson Works. "Edgar Thomson Works, 1873-1936." Tms., October 1936. Prepared for Public Visiting Days, October 19, 20 and 21, 1936.

Carnegie Steel Company, Edgar Thomson Works. "History of Buildings." Tms., N.d. Clairton Map Room. Clariton Works.

## POWER GENERATION AND TRANSMISSION

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Frequency Changer
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Frequency Changer
<u>Location</u>: 500' north of the Monongahela River, and 200' east of the No. 2 Power Station
<u>Construction</u>: 1943
<u>Documentation</u>: There are no photographs of the Frequency Changer

### DESCRIPTION

The Frequency Changer measures 72' x 42' and is 59' high. The foundation and floors are concrete. It is a steel frame structure with common-bond, red brick curtain walls. There are no windows. The flat roof is covered with tar and gravel.

The first floor contains transformers for converting 4400 Volt current to 110 Volt and rectifiers for converting DC current to AC. The second floor contains converters for changing 25 cycle current to 60 cycle.

The Frequency Changer interconnects the 44KV, 25 cycle system, presently used at Edgar Thomson and Clairton, with the 69 KV, 60 cycle system, which is linked to the Edgar Thomson Works and Duquesne Light Company, the public utility.

### HISTORY

The Frequency Changer was installed in 1943 as a response to new power demands placed upon U.S. Steel's Mon Valley system as a result of the installation of the Irvin Works and Edgar Thomson's slabbing mill in 1938 (60 cycle), and the Defense Plant Corporation's installation of the Duquesne Electric Furnace Plant (60 cycle) and the Homestead 160" Plate Mill (25 cycle) in 1943.

<u>Source</u>:
Cramer, F. W., L. W. Morton, and A. G. Darling. "The Electronic Frequency Changer." <u>Iron and Steel Engineer</u> 22(January 1945): 52-67.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Gas Meter House
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Gas Meter House
<u>Location</u>: 3775' east of Gate No. 2, and 25' south of Braddock Avenue, east of the Open Hearth Plant

Construction: unknown
Documentation: There are no photographs of the Gas Meter House.

DESCRIPTION

There are two buildings, both associated with natural gas metering. The larger and older building measures approximately 40' x 12'. It is a steel shed structure with a concrete foundation and floor. The gable roof is covered with sheet metal and fitted with three ventilators along the ridge. There are gas regulators and pipes inside.

The smaller and newer building, located just east of the other, measures approximately 24' x 20'. It is a concrete-block structure with a flat roof.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, No. 1 Power House/Station
Present Name: USX Corporation, Edgar Thomson Works, No. 1 Power House/Station
Location: 775' north of the Monongahela River, and 60' east of Blast Furnace No. 1
Construction: c. 1897
Documentation: There are no photographs of the No. 1 Power House/Station.

DESCRIPTION

The No. 1 Power House measures 290' x 140'. It is two stories with a basement, and is approximately 55' tall. The foundation and main floors are concrete. It is a steel frame structure with common-bond red brick walls. There are arched window openings which have been infilled with brick or translucent fiberglass. The monitor roof is supported by a Fink truss and is covered with corrugated sheet metal.

The interior is divided into a Pipe Shop on the east end, the Switch Room on the northeast side, the Fan Room on the southwest, and the main Generator floor in the central section.
The Pipe Shop contains five pipe threaders and a bending table, dating to about 1960, and four offices. The Switch House contains buses and switch gear equipment. The Fan Room, formerly the Old Pipe Shop, and prior to that the Old Power House, is devoid of equipment. Positioned on the Generator floor is a General Electric, AC, 6,660 volt, 1,500 KW turbo-generator powered by a 250 psi Curtis steam turbine producing a 25 cycle current. It was installed in 1931. The basement contains the condenser for the generator and an electric, Nagel water pump. A tunnel connects the basement with Substation #3.

## HISTORY

In 1897 the Foundry Power House and the Mill Lighting Plant were demolished and the Powerhouse was built. Equipment consisted of two 400 KW Buckeye, horizontal, tandem, cross-compound engine generators and one 800 KW, vertical, cross-compound engine driven generator. Shortly thereafter, a second 800 KW, vertical, cross-compound engine-driven generator was added. In 1905, with the addition of No. 3 Rail Mill, the Power House was expanded to its present dimensions. At this time, two 1500 KW, 250 Volt, DC, vertical cross-compound engine-driven generators were added. In 1912, when the Open Hearth Plant and new Bloom Mill and Rail Mill were added, a 3500 KW, 25 cycle, 6600 Volt, AC turbo-generator was installed. The present 1,500 KW, AC turbo-generator was installed in 1931.

With the construction of No. 2 Power Station in 1943, the facilities at #1 were phased-out and removed. Currently, only the 1,500 KW, AC turbo-generator remains on standby.

Sources:
Abbiss, R. D. and D. C. West. "Conversion and Distribution of General Purpose D. C. Power in Large Industrial Plants." Iron and Steel Engineer (March 1931): 108-116.

United States Steel Corporation, Edgar Thomson Works. "Maintenance Department, No. 1 Power House, Furnace Pipe Shop, Relocation of Pipe Shop to East End of Building." Drawing #B-15-316. April 27, 1962.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, No. 1 Substation
Present Name: USX Corporation, Edgar Thomson Works, No. 1 Substation
Location: 60' south of Braddock Avenue, 512' west of the Slab Mill Water Quality Control Station, and north of Machine Shop
Construction: 1910
Documentation: There are no photographs of the No. 1 Substation.

## DESCRIPTION

No. 1 Substation measures 81'-9" x 32'-3" and is one story with a basement. It has concrete foundations and floors and the walls are common-bond red brick. The windows, in-filled with concrete block, are set in arched openings. The roof is supported by a metal Warren truss and covered with corrugated metal.

The building contains two identical motor-generator sets dated 1910. The motors are Westinghouse, synchronous motors, 1440 hp, 60 cycles, 6000 volts. The DC generators are Westinghouse, 1000 KW, 250 volts, 4000 amps. The No. 1 Substation has been out of service for some time.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Stirling Boiler House
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Stirling Boiler House
<u>Location</u>: 625' north of the Monongahela River, and 450' east of Power Station No. 2
<u>Construction</u>: 1925
<u>Documentation</u>: There are no photographs of the Stirling Boiler House.

DESCRIPTION

The Stirling Boiler House measures 328' x 84'. It is a steel frame structure covered with corrugated metal. It has three bays, including a central bay with gable roof and two lean-to bays. It is approximately 70' tall with three main floors: the ground floor, the firing floor, and the fan floor, together with intermediate operating platforms. A coal hoist, positioned on the southwest side, towers approximately 20' above the roof of the central bay. The foundation and main floors are concrete. There are rectangular windows openings, covered with metal louvers, on the three main floors. The gable roof of the central bay is supported by Fink trusswork. The roof is covered with corrugated sheet metal.

The eight boilers are Stirling, Class No. 13 and No. 40, water tube, twin-units, arranged in a single row in the center of the building. Boilers 1 through 4 are arranged to burn Blast Furnace gas; boilers 5 through 7 either Blast Furnace gas or coal; and Boiler No. 8 coke breeze. Boilers 6 through 8 are equipped with Combustion Engineering stokers. All of the boilers are equipped with tubular air preheaters. A Link-Belt skip hoist is used to deliver the solid fuels to the boiler furnaces. Each boiler has one forced draft fan and two induced draft fans, each electrically-driven and manufactured by the Green Fuel Economizer Company. The five feed water pumps are steam driven and manufactured by Worthington Pump & Machinery Co. The four, open-type, feed water heaters were manufactured by the Edgar Thomson Works.

The boiler feed water treating plant consists of ten tanks with a capacity of 230,000 gallons, batch tanks, and a gravity sand filter. In operation, feed water is preheated by passing through the cooling system of the blast furnace, then lime is introduced to reduce acidity. The water is then allowed to settle in the tanks, after which soda is added. The water is then passed through the sand filter to the cold well from which point it is pumped to the feed water heaters before it is delivered to the boilers.

In addition to the shutdown steam generation equipment, a two-stage, Chicago-Pneumatic air compressor is located on the ground floor of the building. This steam-driven compressor is presently in operation.

## HISTORY

The construction of the Stirling Boiler House in 1925-27 was a major step in the centralization of steam generation facilities at the Edgar Thomson Works. Prior to its construction, there were seven boiler plants containing 168 boiler units located at various points throughout the plant.

In 1957 the facility was renovated with the installation of new blast furnace gas burners and automatic controls for the fans and feed water equipment. The facility was shut-down in 1978.

Sources:
Carnegie Steel Company, Edgar Thomson Works. "History of Buildings." Tms., N.d., Clairton Map Room, Clariton Works.

Abbiss, R. D. "Recent Boiler Plant Installation at Edgar Thomson Works, Carnegie Steel Company." Iron and Steel Engineer. (June 1927): 285-296.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, No. 2 Power Station
Present Name: USX Corporation, Edgar Thomson Works, No. 2 Power Station
Location: 410' north of the Monongahela River, and 2725' east of 11th Avenue
Construction: 1943

Documentation: There are no photographs of the No. 2 Power Station.

## DESCRIPTION

No. 2 Power Station measures approximately 210' x 190'. There are three main floors, the ground floor, the second or turbo floor, and the third or firing floor. The station is 127' tall at its highest point over the boilers. The foundation and main floors are concrete. It is a steel frame structure with common-bond, red brick curtain walls. There are a small number of rectangular windows and louvered openings on the third floor. The flat roof is supported by a flat, Warren truss, and consists of concrete roof slabs covered with composition roofing.

The Screen House, Water Treatment Room, and Pumping Station are located on the first floor. The Screen House, situated in the south corner of the main building, contains two sluice gates manufactured by the Chapman Valve Company, an electric de-watering pump, and two traveling water screens. The Water Treatment Room, located in a steel-framed, 40' x 20' addition on the west side of the main building, contains filtration tanks, chemical tanks, and electric treated water pumps. The Pumping Station, located in a sump pit in the southeast section of the main building, contains two electric circulating water pumps by Pomona, an electric blast furnace circulating water pump by Pomona, a steam general service water pump by Pomona, a steam fire pump by Pomona, two steam boiler feed water pumps by DeLaval, two steam condensate pumps by Pennsylvania Pump & Compressor, two electric condensate pumps by Pennsylvania Pump & Compressor, an electric condensate booster pump by DeLaval, three oil pumps, and three sump pumps.

During operation, river water is screened at the Screen House, pumped to the Settling Tanks, located 240' northwest of the No. 2 Power Station where the water is limed and decanted, then pumped to the Water Treatment Room, where it is treated with soda, filtered, then pumped to the boilers.

The turbo-blowers and turbo-generators are located mainly on the second or turbo floor, but extend to the first floor below. The two turbo-generators are identical make: Allis-Chalmers, 25,000 KW, 31,250 KVA, 13,800 Volt, driven by 650 psi steam, and generate a 60 cycle, AC current. The condensers are the surface-type, manufactured by the Condenser & Heater Manufacturing Company. The turbo-generators are designated 1A and 2A. Presently 2A is in operation, while 1A is being overhauled. The turbo-blowers are designated 1A, 2A, 3A, and 4A. 1A and 2A, presently on standby, are DeLaval centrifugal blowers, 30 psig, driven by DeLaval steam turbines with surface condensers manufactured by Condenser & Heater Corporation. Turbo-generators 3A and 4A, presently in service, are Allis-Chalmers, axial compressors driven by 24000 hp, General Electric steam turbines operating at 225 psig, and equipped with surface condensers.

The three boilers and associated equipment are located in the central part of the building and extend from the ground floor to the third or firing floor. The three boilers are 3-drum units generating 300,000 lbs. of steam per hour, with superheaters, manufactured by the Riley Stoker Corporation. They burn both blast furnace gas and pulverized coal. Coal is prepared for the water-cooled furnaces by an electric, Pennsylvania Crusher Company coal crusher and Riley Stoker Corporation coal pulverizers. The induced draft fans are driven by steam turbines and were manufactured by the Green Fuel Economizing Company. The forced draft fans are also steam-driven and manufactured by Green Fuel Economizing Co.

The Liming Plant, located approximately 40' east of the main building, measures 42'-6" x 16' and is 77'-2" tall. It is a steel frame structure with corrugated, asbestos-cement composite siding topped by a gable penthouse. Contaminated with asbestos and shutdown about 1979, it contains concrete bins, slake tanks and pumps formerly used for liming boiler feed water.

The 69 KV Switching Station is located 40' southeast of the No. 2 Power Station. Also on this southeast side is an approximately 16' x 12', one-story red brick building with gable roof and corrugated metal roof covering which is used for chlorine tank storage.

## HISTORY

No. 2 Power Station was completed in 1943 as a part of the Defense Plant Corporation's mill improvements. It has been in service since that time. The only major change in the facility was the abandonment of the Liming Plant and construction of the Water Treatment Room around 1979.

<u>Sources</u>:

Defense Plant Corporation. "Blast Furnace, Braddock, Pa., Plancor 202." Reproduced at the National Archives.

Carnegie-Illinois Steel Corporation, Acting For and On Behalf of Defense Plant Corporation - Plancor 202. "No. 2 Power Station, List of Equipment." Drawing #ET-B-2-259. June 7, 1944.

Carnegie-Illinois Steel Corporation, Defense Plant Corporation. "No. 2 Power Station, Liming Plant, Plans & Elevations." Drawing #ET-B-2-424. August 3, 1942.

Carnegie-Illinois Steel Corporation, Defense Plant Corporation. "No. 2 Power Station, Plan at Elev. 738'-8"." Drawing #ET-B-2-250. April 28, 1943.

## AUXILIARY BUILDINGS AND SHOPS

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Air Compressor & Air Tank Buildings
Present Name: USX Corporation, Edgar Thomson Plant, Air Compressor & Air Tank Buildings
Location: 250' north of the Monongahela River, 1,000' east of Blast Furnace #1, and just south of the Foundry Machine Shop
Construction: c. 1910
Documentation: There are no photographs of the Air Compressor & Air Tank Buildings.

### DESCRIPTION

The Air Compressor Building measures approximately 48' x 36'. It is a one story, common-bond brick building. The foundation and floor are concrete. The arched window openings are in-filled with translucent fiberglass. The gable roof is supported by a Fink truss covered with corrugated metal sheeting. The building is presently used for storage of coils of "Tiger" brand steel cable.

The Air Tank Building measures approximately 26' x 30'. It is a two-story, common-bond brick building with concrete foundation and floor. The arched windows are in-filled with brick. The sloped roof is covered with corrugated metal sheeting. A metal air tank, with piping and valves, is located on the second floor.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Brick Shed
Present Name: USX Corporation, Edgar Thomson Plant, Brick Shed
Location: 3,550' east of No. 2 Gate, 12' south of Braddock Avenue, and just north of the Open Hearth Stock House
Construction: Unknown
Documentation: There are no photographs of the Brick Shed.

### DESCRIPTION

The building measures about 190' x 60' and is one story. The foundation and floor are concrete. The walls are common-bond, red brick, with the exception of approximately one-half of the south wall, which is sided with wood. There are rectangular windows on the wood-sided portion of the south wall. The wood doors on the side are set in arched openings and appear to be original. The roof is supported by a wood, pin-connected Howe truss and is covered with metal sheeting.

The building contains several stacks of refractory brick and mortar mix.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Brick Storage Building
<u>Present Name</u>: USX Corporation, Edgar Thomson Plant, Brick Storage Building
<u>Location</u>: 600' south of Braddock Avenue, 1,350' east of No. 2 Gate, northwest of No. 2 Ore Yard
<u>Construction</u>: c. 1940
<u>Documentation</u>: There are no photographs of the Brick Storage Building.

DESCRIPTION

The building measures approximately 212' x 96' and is one story. The foundation and floor are concrete. The steel frame structure is covered with corrugated metal sheeting on the west side and open on the north, south, and east sides. The gable roof is supported by a Fink truss and covered with corrugated metal sheeting.

The building's historic and present use is for the storage of refractory brick.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Carpenter's Room/Paint Shop
<u>Present Name</u>: USX Corporation, Edgar Thomson Plant, Carpenter's Room/Paint Shop
<u>Location</u>: 800'north of the Monongahela River, and 325' east of #1 Blast Furnace
<u>Construction</u>: c. 1901
<u>Documentation</u>: There are no photographs of the Carpenter's Room/Paint Shop.

DESCRIPTION

The Carpenter's Room/Paint Shop measures approximately 128' x 28'. It is a two-story, common-bond, red-brick structure. The foundation and floors are concrete. The arched window openings are in-filled with brick. The gable roof is supported by a wood truss and is covered with slate or ceramic tile.

The building is divided into the Carpenter's Room on the north, which includes lockers and showers, and the Paint Shop on the south. A tower with a steel tank on top, with ducts leading to the Pattern Shop, is positioned on the west side. This was used to draw sawdust from the atmosphere of the Pattern Shop. Next to the tower is a furnace (with graffiti, "Ike's Bakery") which was used to incinerate the sawdust.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Police Chief's Residence and Superintendent's Dining Hall
Present Name: USX Corporation, Edgar Thomson Plant, Club House
Location: Southeast corner of Braddock Avenue and 13th Street
Construction: 1912
Documentation: There are no photographs of the Club House.

DESCRIPTION

The building measures 86'-10" x 54'-9", and is two stories with a cellar.

The building rests on a concrete-block foundation. The exterior walls are common-bond red brick. Windows are set in openings with brick jack-arches and stone cornerstones and lintels. The original sash is 1 x 1, but many of the openings, especially on the second floor, have been infilled with concrete-block. There are verandas on the northeast or front side and on the northwest side with terra cotta tile floors and a porch on the southwest side. The sloping roof is covered with slate.

The second floor interior is divided into offices. The walls are plaster and lathe and much of the wood molding, transoms, and doors appear to be original. The first floor is undergoing asbestos removal. The reception room on the first floor has wood paneling on the walls and ceiling. The classical-motif stone fireplace and mantel in this room was recently removed and placed in the steel shed north of the Slab Mill Shipping Building No. 2. The basement has a concrete floor and contains boxes of unknown materials.

HISTORY

Built in 1912, the Club House was used for housing managerial personnel. It included dining and lounging rooms on the first floor and bedrooms on the second floor. The building was demolished on June 25, 1990.

Sources:

Carnegie Steel Company, Edgar Thomson Works. "Club House, Proposed 1st and 2nd Floor Plans." Drawing #L-11-121. May

15, 1912.

Carnegie Steel Company, Edgar Thomson Works. "Club House, Front Elevation." Drawing #L-H-134. June 13, 1912.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Electric Repair Shop
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Electric Repair Shop
<u>Location</u>: 60' south of Braddock Avenue, and 370' west of Gate No. 2, just west of the LCL Storage Building/Mill Store Room
<u>Construction</u>: prior to 1929
<u>Documentation</u>: There are no photographs of the Electric Repair Shop.

DESCRIPTION

The building is attached to the LCL Storage Building/Mill Store Room. It measures 244'-10" x 62' and is two stories.

The structure has common-bond red brick walls encasing steel columns. It is built upon on a concrete foundation and floor. The windows and doors are set in arched openings. The roof is supported by a Fink truss with pinned members.

The first floor is laid-out for storage and is equipped with metal racks. There are remnants of a narrow gauge track present. The ceiling of the first floor is concrete molded in a scalloped design. The first floor is connected to the second floor by an Otis elevator. The second floor, also used for storage, has tongue-in-groove wood flooring.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Forge
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Machine Shop/Forge
<u>Location</u>: 125' south of Braddock Avenue, 30' east of Locomotive Shop, and west of, and adjacent to, the Machine Shop
<u>Construction</u>: 1892
<u>Documentation</u>: Photographs of the Forge and Machine Shop can be found in HAER No. PA-384-E.

DESCRIPTION

The Forge, attached to the Machine Shop, measures 136' x 92'. It is one story with a clerestory and is about 40' from the floor to the bottom chord of the truss. The foundation is concrete; the floors are concrete with some areas of dirt. The walls are common-bond red brick, and they encase steel columns. The windows are set in arched openings, most of which have been in-filled with concrete block. There are sliding wood doors on the north and south sides. The clerestory contains green, translucent fiberglass. The monitor roof has a Fink truss and is covered with corrugated metal sheeting.

The interior is laid-out so that the north side contains old forge equipment, while the south side contains three air compressors, one of which is in service.

I. Forge Equipment:

A. Heating Furnace, brick with steel beams and doors, natural gas-fired of unknown make, installed in 1892;

B. Punch Press, electrically-powered and manufactured by Long & Allstatter, c. 1920;

C. Steamhammer, originally 2,000 lbs. steam, but converted to electricity, c. 1920;

D. Batch Furnace, brick, natural gas fired, c. 1920;

E. Electric Furnace, brick, manufactured C.I. Hayes, 40 KW, 220 volts.

II. Air Compressors:

A. Joy, four cylinder, two-stage with a Westinghouse 400 hp motor, c. 1950, in service;

B. Chicago Pneumatic, two-stage with a Westinghouse 300 hp motor, on stand-by;

C. Joy, two-stage, with 125 hp motor, which is partially dismantled.

## HISTORY

An 1892 drawing indicates that the original equipment in the forge included two heating furnaces, a 5-ton steam hammer, two boilers, a 5-ton jib crane and a 10-ton jib crane.

The Forge Building was consolidated with the Machine Shop in c. 1920 and partially modernized.

The extant forge furnace is on the northwest side of the building. It is the only visible remnant of the original equipment.

Sources:
Edgar Thomson Steel Works. "Heating Furnace for Forge." Drawing #L-13-78. June 22, 1892.

Edgar Thomson Steel Works. "Plan and Section of Forge."

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Foundry Machine Shop
Present Name: USX Corporation, Edgar Thomson Works, Foundry Machine Shop
Location: 290' north of the Monongahela River, and 950' east of Blast Furnace #1
Construction: 1896
Documentation: There are no photographs of the Foundry Machine Shop.

DESCRIPTION

The building measures approximately 260' x 80' overall. It is one story with a clerestory, and measures approximately 40' from the floor to the bottom chord of the truss.

The steel frame structure has common-bond, brick curtain walls. The foundation and floors are concrete. Most of the arched windows are infilled; a few are fit with translucent fiberglass. The monitor roof is supported by a Fink truss and is covered with corrugated sheet metal.

The interior is devoted to storage, containing various gears, two Ingersoll-Rand portable air compressors and other spare parts.

There are four, small, ancillary buildings attached to the Foundry Machine Shop.

A. The Oil Storage shed, a one-story, brick structure with arched windows, dating to about 1910, is located on the east side.

B. A concrete-block and steel frame shed, built about 1940, is located east of Oil Storage.

C. A one-story brick lean-to with sloped roof, built about 1950, is attached on the south side.

D. A <u>one-story brick Convenience Building</u>, built about 1900, is located on the west side.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Ingot Mold Foundry
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Ingot Mold Foundry
<u>Location</u>: 350' north of the Monongahela River, and 490' east of Blast Furnace No. 1
<u>Construction</u>: 1951, pre-1929 for Convenience Bldg
<u>Documentation</u>: There are no photographs of the Ingot Mold Foundry.

DESCRIPTION

The building measures approximately 435' x 370', and is divided into four bays. East to west they are a Sand Conditioning bay, a Sand Ramming bay, a Core Oven bay, and a Casting bay. Each bay has a separate roof truss. The building is one story and is approximately 50' from the floor to the bottom chord of the truss.

There is a one-story, red brick Convenience building, measuring approximately 40' x 20', adjacent to the Foundry on the northeast side. The walls of the building are painted gray. It has a concrete foundation, rectangular windows, and a gable with corrugated roof covering.

The steel frame Foundry building has a concrete foundation. The floor is dirt with some areas of concrete. The walls are covered with corrugated steel sheeting. The three gable roofs are supported by Pratt trusses, fitted with ventilators along the ridgeline, and covered with corrugated metal sheeting. There are eight EOT cranes.

The Sand Conditioning bay contains a Sand Mullor (for crushing, cleaning and delivering molding sand), installed in 1951, with Pangborn and Robinson conveyor belts. The Sand Ramming, which formerly contained two sandslinging platforms and four turntables, is empty, with the exception of a few miscellaneous parts. The Core Oven bay contains nine natural gas-fired, core ovens. Associated with the Core Ovens and situated on the south side of the building is a wet-type, gas cleaning system and small clarifier. The Casting bay is devoid of foundry machinery. It is currently used by the Shasta Company to house its slab-grinding equipment, which consists of two mobile grinders. Shasta, a contracting company, takes reject slabs and grinds off imperfections so they can be shipped to the Irvin Plant.

## HISTORY

The Ingot Mold Foundry was built in 1951 on the site of No. 2 Foundry. It operated until 1983.

A 1929 site plan indicates that the Convenience Building on the northeast side of the structure dates to before 1929. (See Drawing K-11-206 at Clairton.)

Sources:
Carnegie Steel Corporation, Edgar Thomson Works. "Plan of Edgar Thomson Works' Furnaces and Foundries, Dismantled Buildings Map." Drawing #L 25 87A. September 4, 1929.

Carnegie Steel Corporation, Edgar Thomson Works. "History of Buildings." Tms. Clairton Works.

Carnegie Steel Corporation, Edgar Thomson Works. "Replacement of Foundry Facilities." Drawing #K 11 106. January 23, 1952.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Ingot Stool Foundry
Present Name: USX Corporation, Edgar Thomson Works, Ingot Stool Foundry
Location: 500' north of the Monongahela River, and 800' east of Blast Furnace No. 1
Construction: 1917
Documentation: There are no photographs of the Ingot Stool Foundry.

## DESCRIPTION

The building measures approximately 205' x 100' overall. It is one story with a clerestory, and is approximately 40' from the floor to the bottom chord of the truss.

The steel frame structure has brick curtain walls on the north and west sides and a portion of the east side, while the other two sides are covered mostly with corrugated metal sheeting. The foundation and floors are concrete. There are windows on the first floor, clerestory and also along the monitor of the roof. The monitor roof is supported by a Fink truss and is covered with corrugated sheet metal.

There are three, small ancillary buildings attached to the Foundry:

A. The Core Room, a one-story, steel shed with concrete foundation and floors is situated on the east side. It contains a Carver rapid sand muller, a "U.S." dual-wheel grinder, and a pattern-drawing press, all of which appear original.

B. The Storage building, a two-story, red-brick structure positioned on the west side of the building in such a way to suggest that the Foundry was shoehorned around it in 1917.

C. A one-story, brick shed with rail columns is attached on the east side and is in a state of near-ruin.

The interior of the foundry is devoid of machinery. It contains a few slabs and bundles of refractory brick.

## HISTORY

The Ingot Stool Foundry was built in 1917 on the site of the Brass Foundry. The building was extended by three bays on the east side in 1941.

A 1929 site plan indicates that the red-brick Storage building on the west side of the building dates to the pre-1929 era.

Sources:

Carnegie Steel Corporation, Edgar Thomson Works. "Plan of Edgar Thomson Works' Furnaces and Foundries, Dismantled Buildings Map." Drawing #L 25 87A. September 4, 1929.

Carnegie Steel Corporation, Edgar Thomson Works. "History of Buildings." Tms., Clairton Works.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Casting Storage Building, Babbitt Shop
Present Name: USX Corporation, Edgar Thomson Works, Mobile Equipment Repair Shop (Locomotive Shop and Automotive Shop)
Location: 85' south of Braddock Avenue, and 1450' east of Gate No. 2
Construction: 1922
Documentation: There are no photographs of the Mobile Equipment Repair Shop.

## DESCRIPTION

The Mobile Equipment Repair Shop measures 282' x 101'. It is one story with a clerestory fitted with green, translucent fiberglass. The structure is composed of a steel frame with corrugated metal siding. The foundation and floors are concrete.

The north aisle of the structure is the Locomotive Shop, while the south aisle is the Automotive Shop. Each aisle has a lean-to and a separate roof system with crane. The roofs have a Fink truss and are covered with corrugated metal sheeting topped with "oil-can" ventilators.

The interior of the Locomotive Shop is laid-out with two sets of regular gauge tracks, each with below-grade repair pits and elevated platforms for engine work. Several engines were being repaired and several chassis rebuilt at the time of the survey. The Automotive Shop is divided into shop bays, each with a tool chest and work bench.

## HISTORY

The Mobile Repair Equipment Shop was built in 1922, and originally called the North and South Casting Storage Building. It was extended on the east end in 1929 and repaired in 1954. In 1961 the building was remodeled into the Mobile Equipment Shop.

Sources:
Carnegie Steel Company. "Diagram of Location for Casting Storage Building." Drawing #L. 16. 70 "B". September 15, 1922.

Carnegie Steel Company, Edgar Thomson Works. "History of Buildings." Tms., Clairton Map Room, Clairton Works.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Machine Shop
Present Name: USX Corporation, Edgar Thomson Works, Machine Shop
Location: 160' south of Braddock Avenue, and 900' east of Gate No. 2.
Construction: 1906
Documentation: Photographs of the Machine Shop can be found in HAER No. PA-384-E.

## DESCRIPTION

The Machine Shop, attached to the Forge, measures 380' x 92'. This includes a lean-to on the northeast side. The building is one story with a clerestory and is about 32' feet from the floor to the bottom chord of the truss.

The foundation is concrete; the floors are concrete with some areas of wood. The steel frame structure has common-bond red brick walls. The window openings on the first floor and the clerestory have arched openings fitted with what appears to be original sashes. The windows in the monitor are translucent green fiberglass. The monitor roof is supported by a Fink truss and is covered with corrugated metal. The lean-to has a half-Warren truss. A neon sign, "Edgar Thomson Works, US Steel" is attached to the roof of the building.

The building is equipped with a forced-air space heating system. The main section contains various spare parts, along with a 28-ton EOT crane and a 50-ton EOT crane. The lean-to is equipped with a 3-ton EOT crane, a blast cleaning machine, and an electric jigsaw.

HISTORY

Built in 1906, the Machine Shop originally included a Boiler Shop and Smith Shop. Original equipment in the Machine Shop section included a 56" lathe, a 48" lathe, three 20" lathes, two turret lathes, a drill press, a #4 bolt cutter, a #3 horizontal mill, a 36" lathe, a 25" lathe, a 42" boring mill, a 26" lathe, a 24" lathe, two gear cutters, a 36" double lathe, an 100" boring mill, a floor boring mill, a 96" planer, a 60" planer, a 42" planer, a 36" planer, a burt gear planer, a 12" shaper, a 24" shaper, and a milling machine. About 1920 the building was consolidated with the Forge and extended.

The sign, which reads "Edgar Thomson Works, US Steel," was placed atop the building in 1929. It was changed in 1951, but the steel supports were retained. It is currently not working.

Source:
Edgar Thomson Works. "Brick Work for Mill Machine Shop." Drawing #L-13-58. Nd.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Metallurgical Lab
Present Name: 1st floor: Dining Room; 2nd floor: Engineering, MPO, Utilities, Slab Mill Metallurgical Offices
Location: 450' south of Braddock Avenue, and 1600' east of Gate No. 2.
Construction: c. 1950
Documentation: There are no photographs of the Metallurgical Lab.

DESCRIPTION

The building measures approximately 125' x 50'. It is a two-story concrete-block building with small rectangular window openings. The floors and foundation are concrete. The flat roof is covered with tar and gravel.

The first floor of the building is divided into one dining room and a smaller kitchen. It is a diner used by management personnel. The second floor is divided into several modernized offices.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Ore Thawing House
Present Name: USX Corporation, Edgar Thomson Works, Ore Thawing House
Location: 600' south of Braddock Avenue, and 1,325' east of the BOP Gate
Construction: 1943
Documentation: There are no photographs of the Ore Thawing House.

DESCRIPTION

The Ore Thawing House measures 98' x 21'-6". It is two stories and approximately 50' tall. It is a steel frame structure reinforced with exterior concrete columns. The walls are common-bond red brick. There are no windows. Two metal sliding doors are positioned on the northeast and southwest sides. A regular gauge track, upon which is an ore transfer car, and a narrow gauge track, upon which there is a transfer car puller (a.k.a. "Mickey Mouse") are on the first floor.

The second floor, which was inaccessible, contains a natural gas-fired heating furnace, fans, and duct work for producing heated air to thaw the ore.

HISTORY

The Ore Thawing House was built by the Defense Plant Corporation in 1943. In operation it had a capacity of two cars and a thawing cycle of twenty-seven minutes.

Source:
Defense Plant Corporation. "Blast Furnace, Braddock, Pa, Plancor 202." n.d.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Pattern Shop
Present Name: USX Corporation, Edgar Thomson Works, Pattern Shop
Location: 775' north of the Monongahela River, and 450' east of Blast Furnace No. 1
Construction: 1901
Documentation: There are no photographs of the Pattern Shop.

## DESCRIPTION

The Pattern Shop measures approximately 260' x 65'. The northern section has three stories, while the southern section has five.

The steel frame structure has common-bond, red brick walls. There are arched window openings on the first floor, most of which have been covered with translucent fiberglass. There are no windows on the upper stories. The upper floors are supported by a row of interior steel columns; the ceilings are composed of poured concrete sections, molded in the form of multiple arches. Two elevators with exterior shafts, a newer model on southern section and an older one on the northern section, connect the floors. The gable roof of the northern section is supported by Fink trusswork and covered with corrugated metal sheeting. The gable roof of the southern section is supported by structural steel rafters buttressed by a row of steel columns under the ridge beam. The southern section has wood sheathing and is covered with either slate or ceramic tiles.

The first floor contains the following machinery:

A. bandsaw,
B. table saw by Woodworking Machinery Co.,
C. rotary saw,
D. Baird Jointer,
E. rip saw,
F. Oliver mortise saw,
G. planer,
H. shaper by Briggs Machinery Co.,
I. turning lathe by Blount,
J. table saw by Northfield Foundry & Machine Co.,
K. bandsaw, "Do All Contour Machine",
L. planer by Oliver,
M. sander by Oliver,
N. drill press by Orbit Machine Co.,
O. bandsaw by Do All.

All this machinery appears to date to later than the 1940s. The upper floors contain innumerable wood patterns stored in racks. Some of these were photographed, but not inventoried.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, Central Pumping Station/Liming Plant and Settling Basin
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Central Pumping Station/Liming Plant and Settling Basin

Location: 925' east of 11th Ave., adjacent to the Monongahela River
Construction: 1913, c. 1960 for Settling Basin
Documentation: There are no photographs of the Central Pumping Station/Liming Plant, or Settling Basin.

DESCRIPTION

The Central Pumping Station measures 283'-4" x 84'. The Liming Plant, located adjacent to the pumping station on the east side, measures 84' x 36'-4". The pumping station has two stories, including the pump floor on grade with the river, and the inspection floor, which has a mezzanine. The Liming Plant is one story with a mezzanine and measures approximately 30' from the floor to the truss.

The Central Pumping Station is a steel frame structure with common-bond, red brick curtain walls. The foundation is concrete. The floors are ceramic tile. The arched windows are infilled with brick. The roof is supported by a Warren truss and is covered with corrugated sheet metal.

The Liming Plant is similar in construction to the pumping station, with rectangular, rather than arched, windows. They have been infilled with brick.

Along the river side of the Central Pumping Station is a concrete and steel basin with eight forebays where there are water intakes fitted with sluice gates and traveling screens. The west end of the pump floor is dedicated to storage. The east end contains two strainers, two steam-driven, Wilson-Snyder pumps, one of which is in operation, and four Wilson-Snyder, pumps, one of which is in operation, with 1,000 hp motors. Additionally there are four smaller American-made pumps with 20 hp motors. Also on the pump floor, and extending up to the inspection floor, are valves and drive shafts for automatic operation of the steam inlets and water outlets of the pumps. The electric motors for opening and closing the valves are located on the inspection floor. The inspection floor of the pumping station is an observation deck with six openings for viewing the pumps. Miscellaneous parts are stored along the walkways. The mezzanines on the north and south side contain steam lines and electric breakers and panels for control of the electric pumps and lights. Adjacent to the pumping station on the north side is a barometric condenser which appears original.

The Lime Plant is used principally for storage. It also contains a two-stage, electric Ingersoll-Rand air compressor, presently in use for operation of instruments in the Oxygen Plant.

The Settling Basin is an approximately 50' x 20' concrete basin located on the east side of the Central Pumping Station. It is periodically cleaned-out with a mobile crane.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, Scalehouse
Present Name: USX Corporation, Edgar Thomson Works, Scalehouse
Location: 25' south of Braddock Avenue, and 3400' east of Gate No. 2, just northeast of the Open Hearth Stockhouse
Construction: pre-1929
Documentation: There are no photographs of the Scalehouse.

DESCRIPTION

The building measures approximately 24' x 12' and is one story with a basement. It is a turrent-shaped, common-bond, red brick building with rectangular window openings, concrete floors and basement. The building has a flat roof. The interior contains an intact railroad scale of unknown capacity.

Historic Name: U.S. Steel Corporation, Edgar Thomson Works, L.C.L. (Less-than-Car Load) Storage Building/Mill Store Room
Present Name: USX Corporation, Edgar Thomson Works, L.C.L. Storage Building/Mill Store Room
Location: 60' south of Braddock Avenue, and 150' west of Gate No. 2
Construction: prior to 1929
Documentation: Photographs of the L.C.L. Storage Building can be found in HAER No. PA-384-E.

DESCRIPTION

The building is attached to the Electric Repair Shop. A foundation wall and other remains of the demolished Oil Storage Building are located just north of the building.

The one-story building measures 221'-6" x 40'. The common-bond red brick walls are built upon a concrete foundation and floor. The windows and doors, many of which have been in-filled with brick, are set in arched openings. The roof is supported by a wood, Warren truss with pin connections. It is covered with corrugated metal sheeting and features two skylights fitted with translucent fiberglass. The interior is divided into offices and storage areas.

## HISTORY

The L.C.L Storage Building/Mill Store Room was built prior to 1929. It was modified in 1933, mainly with the addition of the 120' x 23' Oil Storage Building on the north side. The Oil Storage Building has been demolished, but the store room is currently in use.

Source:
Carnegie Steel Company, Edgar Thomson Works. "Store Room." Drawing #L-11-1092, September 27, 1933.

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| Historic Name: | U.S. Steel Corporation, Edgar Thomson Works, Structural Shops (Ladle & Car Repair Shop, Fabricating Shop & Erection Shop) |
| Present Name: | USX Corporation, Edgar Thomson Works, Structural Shops |
| Location: | 400' north of the Monongahela River, 1040' from 11th Street |
| Construction: | 1942-3 |
| Documentation: | There are no photographs of the Structural Shop. |

## DESCRIPTION

The Structural Shop includes the Fabricating, Erection, and Ladle and Car Repair Shops. These shops are comprised of three interconnected steel shed buildings, and the Convenience Building, an attached brick structure. Overall, the complex measures 360'-4" x 205'-6". The Ladle and Car Repair Shop in the west bay of the structure is 308'-4" x 79'-6", the central bay Fabricating Shop is 328'-4" x 66', and the east bay Erection Shop is 328'-4" x 60'. The Convenience Building is 90' x 32'. The Erection and Fabricating Shops, along with part of the Ladle and Car Repair Shop, are one-story with a clerestory, while the north section of the Ladle and Car Repair Shop has two stories.

The three shops are steel frame structures with brick curtain walls. The foundation and floors are concrete. The east side of the Ladle and Car Repair Shop and the west side of the Erection Shop have glass windows set in rectangular openings on the floor and clerestory levels. The Erection and Ladle and Car Repair Shops have plain gable roofs; the Fabricating Shop has a monitor roof. All have a riveted Fink trusswork and are covered with corrugated metal sheeting.

The Convenience Building is a one-story, common-bond, red brick building attached as a lean-to to the north side of the complex. It has a sloping, corrugated metal roof.

The Ladle and Car Repair Shop, used for assembly, contains a sub-car, an ingot mold car, and numerous railroad car wheel and axle assemblies. The second floor in the north section contains the Tin Shop with two tin sheet benders, an edger, two soldering furnaces and workbenches, all dating to about the 1930s.

The Fabricating Shop, used to cut and shape metal, contains the following equipment installed about 1945:

A. acetylene metal-cutting machine;
B. "Steelweld" plate shear;
C. 500-ton brake press by "Pacific";
D. "Johnson" drill press;
E. "Cincinnati-Rockford" drill press;
F. Two sets of forming rolls; and
G. "Bertsch & Co." plate bending rolls.

The Erection Shop contains the Pipe Shop, where there are two pipe threaders and a "Racine" pipe shear, dating to about 1945. A No. 100 skip car is also located in this aisle.

HISTORY

Built on the site of "J" & "K" Blast Furnaces in 1942-43, the Structural Shop replaced the earlier Structural Shop, built in 1930, that was located between "C" & "D" Blast Furnaces. It was extended on the south side by 134'-4" in 1947.

<u>Source</u>:
Carnegie-Illinois Steel Corporation, Edgar Thomson Works. "Maintenance Department, New Extensions to Shops." Drawing # L-13-471. April 7, 1947.

<u>Historic Name</u>: U.S. Steel Corporation, Edgar Thomson Works, "J" & "K" Blow Engine House
<u>Present Name</u>: USX Corporation, Edgar Thomson Works, Transfer Car Repair Shop
<u>Location</u>: 760' north of the Monongahela River, and 1,000' east of 11th Avenue
<u>Construction</u>: c. 1902
<u>Documentation</u>: There are no photographs of the "J" & "K" Blow Engine House.

DESCRIPTION

The Transfer Car Repair Shop, including a lean-to on the south side, measures 170' x 60'-4". It is two stories and approximately 60' from the floor to the bottom chord of the truss. It is a steel frame structure with common-bond, brick walls that have been painted gray. The foundation and floors are concrete. The brick walls have been covered with corrugated metal sheeting on the second story. The arched window openings on the first floor have been infilled with brick or translucent fiberglass; the rectangular openings on the second floor have been covered by the corrugated metal sheeting. The monitor roof is supported by Fink trusswork with riveted connections and is covered with corrugated sheet metal.

The lean-to, of the same type of brick construction, is constructed with rail purlins.

The interior contains no _in situ_ machinery except an EOT crane. Both the first floor and the mezzanine are dedicated to the storage of spare parts.

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|---|---|
| Historic Name: | U.S. Steel Corporation, Edgar Thomson Works, Union Railroad Office & Valley Railroad Yard |
| Present Name: | USX Corporation, Edgar Thomson Works, Union Railroad Office & Valley Railroad Yard |
| Location: | The office is 4100' east of Gate No. 2, 370' south of Braddock Avenue, and east of the Open Hearth Plant; The Valley Railroad Yard extends in an eastern direction from the Open Hearth Plant about 300' |
| Construction: | post-1928 |
| Documentation: | There are no photographs of the Union Railroad Office and Valley Railroad Yard. |

DESCRIPTION

The building measures about 40' x 24'. Shaped like a locomotive, the structure is two stories high with a basement, and a penthouse on the east side which served as an observation deck. It is of concrete-block construction with a brick chimney on the west side. The foundation and floors are concrete. The window openings are rectangular. The windows on the penthouse or observation deck occupy nearly the entire wall space, while those on the lower floors are boarded-up. Entrances to the building are located on the east and west sides. The roof is flat.

The building was locked, so the layout and contents of the interior were not inventoried.

The Valley Railroad Yard includes about twelve regular gauge tracks that extend in an easterly direction from the Open Hearth Plant to the end of the plant property. Abandoned rolling stock is parked on these tracks, including cinder-pot cars and three locomotives, one of which is No. 1003 from the National Tube Works, McKeesport, Pennsylvania.